Beyond the horizon of measurement: Festschrift in honor of Ingwer Borg

Braun, Michael (Ed.); Mohler, Peter Ph. (Ed.)

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ZUMA Zentrum für Umfragen, Methoden und Analysen

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Part II: Employee Surveys, Organizational Structure, and Work Values

INTRODUCTION

In discussing recent organizational issues at ZUMA, Ingwer Borg remarked "vielleicht denke ich einfach". However, there are at least some 20 readings or facets of the word 'einfach' in German and most of them are definitely not true for Ingwer. For instance, his scientific goals and achievements are by far not 'simple' at all. Instead, he strives for scientific laws – the most difficult task one can imagine. This is even more remarkable in a world where correlations are taken as indicators of causality, or where 'Verstehen' is misunderstood as scientific evidence. It is also very likely that he does not take the easy way out. At times he, admittedly, has a tendency to make laconic, minimalistic statements. Which is, in a scientific world of verbal inundation, sometimes a deadly sin. Among his masterpieces is a four-line description of an organizational design. Much to the disappointment of the addressees who simply did not want to think for themselves.

However, he has a tendency to be modest. A glance at his œvre reveals a multi-talented, innovative, and cross-disciplinary scientist, who, by all means, could fill his walls with eminent names, topics, positions, and publications. This is in contrast to the frugality of his office, a scientific workbench, not a celebrity's showroom. In addition to his academic pursues he likes to venture into real life, too. One can feel his excitement when listening to his tales and narratives about establishment surveys and consultations he conducts. And there are some other adventures, like a trip on a small mountain road – to the right about thousand meters to the top of the mountain and at the left thousand meters steep downhill (actual length of narrative given here).

Modesty and academic excellence paired with trustfulness and truthfulness, these are the descriptions we would choose, if asked to describe Ingwer Borg in a nutshell. We are honoured to work with him and it is our pleasure and privilege to introduce you, the reader, to this volume.

When we approached friends and colleagues of Ingwer, all readily were prepared to contribute to this 'Festschrift' on the occasion of his 60th birthday. A thank you to all of them. We also would like to express our thanks to Christa von Briel, Carina Leesch, and Lena Vöcklinghaus for her invaluable assistance to the editors.

This volume is organized in two parts. The first part deals with measurement issues including the application of multidimensional scaling to substantive issues but where the method is center-stage. The second part in substantive in focus and deals with questions of the organization of firms and employee attitudes.

The first part on measurement issues is opened by a contribution of *Peter Ph. Mohler* on new developments in organizing questionnaire design. He advocates a team approach with a clear distribution of responsibilities of linked subgroups which are each in charge of one phase of the design process instead of the traditional round-table approach in which in the end only one person has the say. Next are two contributions on multidimensional scaling which deal with special statistical problems and make some progress in further developing the MDS approach for special problems. *Hubert Feger* deals with analytical foundations of multidimensional scaling for ordinal data, based on ranks of proximities. He sketches two approaches, one working with contingencies of distance ranks, represented by boundaries in a dimensional space, and the other using the generalized betweenness relation, leading to configurations of object points. *Patrick J.F. Groenen & Ivo A. Van der Lans* develop a new algorithm for dealing with regional hypotheses on the location of the items in the MDS solution, in particular the axial constraint where the items from different levels of a facet are assumed to be located in different parallel slices. This algorithm works without the restriction that the number of facets equals the number of dimensions. The focus of the next three papers is on the application of multidimensional scaling procedures in different substantive areas. *Arie Cohen* compares a previously published factor-analytic study with a Smallest Space Analysis of the comprehensive scoring system of the Rorschach instrument. *Wolfgang Bilsky* uses multidimensional scaling for analyzing multitrait-multimethod matrices of different motivational indicators, drawing on Schwartz' value theory. *Shlomit Levy & Dov Elizur* compare the perceptual structure of the value systems as well as value preferences of veteran Israelis and new immigrants from the former Soviet Union, guided by a facet-theory approach.

The second part of the volume dealing with questions of the organization of firms and employee attitudes is opened by a contribution of *Simon L. Dolan & Christian Acosta-Flamma* on values and propensity to adopt new Human Resource Management technologies as determinants of Human Resource efficiency and effectiveness. *Sanjay T. Menon* presents a case study in alternative management, a medium-sized family-run organization in the US with 600 employees, which functions without formal management structures or titles. *Christiane Spitzmüller & Dana M. Glenn* discuss different methodologies for the study of nonresponse in organizational surveys and examine socio-demographical variables, attitudes, and organizational and survey characteristics as determinants. The last two contributions address questions of work motivation and job satisfaction of employees.

THOMAS STAUFENBIEL, MAREN KROLL & CORNELIUS J. KÖNIG analyze whether there is a negative effect of job insecurity on performance (mediated by work attitudes) or a positive effect (because job insecurity might also be a motivator). They distinguish two separate dimensions of job insecurity: cognitive job insecurity (i.e., the probability estimate of loosing one's job) and affective job insecurity (i.e., being worried about loosing one's job) which showed different correlational patterns with performance. *MICHAEL BRAUN & MIRIAM BAUMGÄRTNER* analyze the relative contribution of work values (what workers find important in a job) and job characteristics (what their jobs gives them back) on job satisfaction.

A list of selected publications by Ingwer Borg concludes this volume.

Mannheim, November 2006 MICHAEL BRAUN & PETER PH. MOHLER

SAMPLING FROM A UNIVERSE OF ITEMS AND THE DE-MACHIAVELLIZATION OF QUESTIONNAIRE DESIGN

PETER PH. MOHLER

Abstract: *Up-to-date design and development of survey items is like a medieval rite rather than a quality-controlled scientific undertaking. This holds despite existing evidence-based protocols propagated for many years by methodologists. Most prominent is the creation process of items, which in general is not a systematic selection from a universe of items belonging to a specific construct. A case is made here, to give up the round-table ritual of item creation in favor of a well-defined selection process. A differentiation of work roles is advocated in the light of knowledge accrued in other disciplines to streamline the item design and selection process for future surveys.*

Sampling from a universe of items

Whenever survey researchers meet to design and develop a questionnaire they open their gathering with a ritual of sorts. Imagine a setting with a number of eminent survey researchers sitting around a table heading for a new survey instrument (questionnaire). Usually the chair sets out to declare that one will apply most rigorous methods and strive for highest standards. His opening statement is followed by a round of positive murmur from all sides accompanied by the culturally acceptable body language, for example, nodding heads into all directions. Then the importance of clear conceptual delineation is stated combined with a pledge to closely connect concepts with relevant theories.

A world-famous saying in Germany says "von nun an ging's bergab" (Hammerschmidt & Knef 1967) (from now on it went downhill), because what follows will be hours, days, and often weeks of entrenched defense of chairs' and other eminent members' beloved 'tried and tested' items/questions. The sometimes heavy battlefield-like inter- and counteractions are 'interluded' by a relaxing, enjoyable activity called 'item tinkering'. After a round of serious, sometimes heated debates whether to choose an item or not, no one can deny the fun of rephrasing items as a common effort to re-establish group cohesion. One

might add, tinkering is also the last resort for opponents to ridicule an item by absurdly rephrasing it. However, as it is the case with hierarchical academic structures, it is the chair who, inevitably, will claim to have the last word.

Apart from the fact that this Round Table Approach is neither in nor according to the books, tinkering or rephrasing points to the strong conviction that one could really improve the measurement property of items just by phrasing them more elegantly. According to the textbooks of item design one can, of course, not endorse this approach.

Rephrasing of items takes advantage of a language property we all know of, but hardly ever use consciously: language actually is infinite. Similar to the natural numbers where one always can add one more number (not countable but enumerable), there is, theoretically, no end to words. Thus there is nothing such as the 'last word'. Although, the universe of survey items appears to be limited compared to every-day language it is also infinite in theory. Just think of the rather straightforward concept AGE, i.e., the time span between today and a person's birth date. Just think of the multitude of ways to ask for AGE:

- How old are you?
- When were you born?
- What is your birth date?
- Could you please tell me the year you were born in?
- Would you like to tell me your age?
- Would you, please, like to tell me your age?
- May I, please, ask for your age?
- May I right now, please, ask for your age?

And so on and so forth, one could add more words and more words, change words, replace words until the end of all ages. However, this tinkering exercise will quickly become boring and tedious. While language in principle is infinite as is our universe, the actual usable universe of items could be fairly small as it is the case with AGE (see also Borg 1992: 16).

The task is then to delineate for all practical purposes a finite universe[1] similar to defining a population of respondents. The next step then is to select or sample items from the universe or population of items. The very notion of 'sampling' items from a universe of items seems to counter every single design principle in survey research. But this holds only, if one does not look over the fence to psychologists and their long tradition in instrument design. They take great efforts to collect all possible items, including variations of wordings. A selection is then made following strict rules of item quality testing. The resulting scales (item batteries with well-defined properties) may contain some hundred items as well as one item only. Other than in psychological testing, survey methodologist up-to-date did not opt for commonly agreed-upon protocols for questionnaire design (cf. international testing association). The listings of 'rules for good question wording' (Groves et al. 2004: 226-235) or textbooks full of 'good and bad' examples cannot count here as well-defined selection criteria as stated in the relevant psychological literature. It is timely that survey methodology adopts a more strict position, i.e., well-defined procedures and rules for the selection of items similar to sampling strategies for selecting respondents.

A scientific sample of respondents is said to be representative of the population under observation. Populations are groups of people living at a specific time in a defined region, belonging to a specific societal stratum, sharing specific characteristics, etc. Similarly, populations or universes of items can be defined as groups of items belonging to a specific theoretical concept (indicators measuring an unobservable construct which itself represents a theoretical concept). Having said this, the question may rise to what extent would such an approach be helpful in survey research (apart from the rather rare case where sociologists and political scientists borrow scales from psychologists)? One might also ask: Isn't this simply a rather academic description what underlies the ritual sketched out above?

Such questions become obsolete, if one adds one more requirement, namely a strictly formal structure, best a predictive one. Items selected must correlate with other items of a scale or other characteristics of interest in a well-defined way, as is the case in Facet Theory.

1 The term 'finite universe' deviates from the contemporary concept of our universe, which is seen being infinite (Rees 2000).

Thus three steps are involved for a scientific sampling of items:

1. Definition of the population of items (finite universe of items)
2. Census of the item population
3. Sampling of items from the population according to well-defined rules.

However, the concept of a universe of items and the necessity to sample items from that universe is only half the story about modern, evidence-based questionnaire design. Because almost all survey questionnaires are composites of items/questions selected from a number of universes, additional procurements must be taken. For instance, a survey may target political participation. Thus, it will contain a sample of items selected from the universe of political-participation items. In addition, researches want to know about the social setting of respondents. Thus, they will need a sample of items from the universe of social settings (often called 'background variables'). They also might be interested in values held by respondents and their personal traits. Thus, they will have to include item samples of the respective universes. Designing the questionnaire for a social survey is thus much more complex than to develop a 'one universe' test instrument. The increase in complexity, scope(s), and technology asks for a radical different approach than the Round Table mentioned before. Instead, an evidence-based professional route has to be taken. This in turn will change the Round Table Approach into a quality-controlled survey production process. In the following we will sketch out this new setting.

De-Machiavellization of questionnaire design

Let us come back to the introductory scene. What would be needed to turn the academic discourse and debate into a scientific procedure? The first new aspect would be that everyone in that room is aware that there are always several strategies at hand how to define item populations, create a good census of the item populations and the various sampling strategies possible. Secondly, the discussion will concentrate on which procedural approach will be optimal at each production step. After having decided upon this, the roles of the different players will be clearly assigned (see Noelle-Neumann & Petersen 2005: 110). Finally, the quality controls will be agreed, which allows to test whether the design process successfully leads to quality items.

Defining specific professional roles of participants and the implementation of a quality control process would be the major transition from an academic ritual to an up-to-date scientific endeavor. Because proper questionnaire design and item development requires different skills, talents, and knowledge on different stages we need at least nine professional roles:

1. excellent knowledge of the subject area (necessary for the definition of the item population),
2. institutional and cultural expertise (necessary to identify culturally or institutionally inacceptable item formulations),
3. linguistic knowledge (necessary to identify odd phrases),
4. texter skills (talent for creative writing like in marketing),
5. measurement and statistical expertise (to inform others involved in the design process about desirable measurement properties and the resulting analytical possibilities),
6. cognition & survey research know-how (to check for unintended effects),
7. information-technology know-how (searching and identifying of existing items),
8. documentation knowledge (for 'real time' production process documentation),
9. last but not least survey-process quality know-how (to inform developers and users about the level of quality achieved).

There is no single person who rightfully could claim to master all the knowledge, know-how, skills or talents for all roles simultaneously. Hence, the 'Round Table Approach' is obsolete in a modern Survey Methodology setting. It will be replaced by a Team Approach, where roles and decision power are clearly set out from the very beginning of the design process. Forming a quality team-production process is, of course, nothing new under the sun in areas outside of survey research (Deming 1986). It will be, however, a revolution to survey research. Instead of a strict hierarchical order with a Principal Investigator acting as Machiavelli's Principe, responsibilities and decisions are now distributed across the questionnaire production chain. In this setting, the Principal Investigator becomes a CEO who is responsible for the overall strategy, i.e., definition of the item population. She will delegate the production process to her team of specialists. As in every good industrial production process, no one can overrule a decision made by anyone in the production chain which is based on protocols agreed before. This will create a balance of power which will enforce Principal Investigators becoming informed by team members, instead of 'having the last word' as an authoritarian academic.

Team-Work Questionnaire Design will be started by a first team which looks into the subject area(s) of the questionnaire and the analyses targeted. Inevitably, this first team will observe a holistic view on the whole production process (i.e., link up with the study

design team (overall survey strategy)) and other teams such as the sample-design team or the data-collection team. The first team will hand definitions of relevant item universes to item-selection teams which will carry out the other eight tasks described above. The finalized instrument will then be handed to the data-collection team which in turn will deliver the data to data editors and finally to data analysts. On each step proper documentation will identify the quality level achieved.

What, hopefully, will not happen in Team-Work Questionnaire Design are the four deadly sins of the Round Table Approach:

1. Items are selected on the sole reason of previous usage, not because of specific measurement properties relevant for the current study.
2. Items are tinkered over and over again without any evidence of improved measurement quality.
3. Mis-designed or badly formulated items make it into pretests (for the sole purpose to convince il Principe).
4. Questions from different item universes are just 'glued', instead of the questionnaire being 'durchkomponiert' (i.e., completely designed).

Finally, one might ask whether all the fun of questionnaire development will be gone with tinkering in favor of a technically machinery? Of course not, it is just a change from a group 'catch as catch can' to a well orchestrated team effort and fun.

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SOME ANALYTICAL FOUNDATIONS OF MULTIDIMENSIONAL SCALING FOR ORDINAL DATA

HUBERT FEGER

Abstract: *Ingwer Borg has contributed intensively and successfully to MDS, in theory and applications (e.g., Borg 1981a,b; Borg & Lingoes 1987; Roskam, Lingoes & Borg 1977). This paper offers some notes on the foundations of MDS, based on ranks of proximities. Two approaches are sketched, one working with contingencies of distance ranks, represented by boundaries in a dimensional space. The other approach uses the generalized betweenness relation, leading to configurations of object points. Details of the procedures and examples for both approaches are given for the one- and two-dimensional case. A procedure to find an optimal solution in a given dimensionality for data with random error is illustrated. The role of facet theory for theory testing by MDS is emphasized. Using the concepts of this paper will allow a fine- grained evaluation of a MDS solution for ordinal data.*

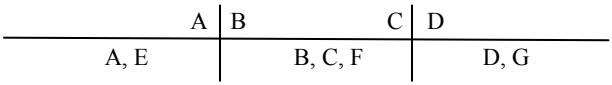
Space as structured by boundaries between points

Placing a point on a line divides the line into two parts. The point functions as a boundary between these parts. We will assume that a point on a line has two sides. Placing two points, A and B, on the same line, a third point may be found with equal distance to both, called by Coombs (1964) – in the context of unfolding theory – the 'working midpoint'. We write this point as A|B for the interval AB between the points A and B. Generalising to **k** > 1 and, with **k** the number of dimensions, one may call this separating boundary the mid-perpendicular hyperplane.

By **N** points $\binom{N}{2}$ boundaries are created. Each boundary divides all points into two sets. E.g. for A|B, some points are closer to A than to B, being located on the A-side of A|B, written C – A|B. The other points are closer to B and thus on the B-side of A|B. In general, two boundaries divide all points into four sets, each point is an element in two sets. On the

other hand, two boundaries on a line define three intervals, two open and one closed. How are the two sets assigned to the three intervals? Figure 1 illustrates one example.

Figure 1 Four sets of points in three intervals on a line



On the A-side of A|B we find {A, E}, on the B-side {B, C, D, F, G}. On the C-side of C|D one sees {A, B, C, E, F}, and on the D-side {D, G}. Such a representation is possible only if one logically possible set of points does not exist. Here this empty set is defined by points on the A-side of A|B and simultaneously on the D-side of C|D. No interval is provided for such a location on the line in Figure 1. The distribution of the points relative to two boundaries may be described by a contingency table. An equivalent to Figure 1 is the fourfold classification in Table 1. The rows refer to the relative distance between points. A point is either closer to A or to B of A|B, written AB if it is closer to A. At the same time, a point is either closer to C or to D. The cells contain the points under consideration. Of course, A must be placed in the *AB*-row because in a metric space it is closer to itself than to B. If the order is A – B – C – D, the assignments in Table 1 result.

Table 1 Contingency table for the distribution of points

	CD	*DC*
AB	A	
BA	B, C	D

One cell, called the *zero cell*, is empty. In Table 1, the zero cell is specified as AB, DC. This is a necessary condition for representing all points on one line, i.e., to give a one-dimensional representation or seriation: For all pairs of pairs of N points, at least one cell in the contingency table is empty.

With more than two points, at least three boundaries and three pairs of boundaries exist. A consistent order between these boundaries must be found with respect to sequence and orientation to each other. The sequence may be written either from ‘left to right’ or from ‘right to left’. The orientation of two boundaries is defined by referring to the fact that the other boundary is either on the one or the other side. E.g. for A|B – A|C, the other bound-

ary of A|B is on its B-side; for A|C, it is on its A-side. The sides of the boundary defining the closed interval are oriented towards each other, or 'inwards'. The other sides are oriented 'outwards'. The rule how to represent the boundaries on a line is: Let a zero cell be defined as **A**B, **D**C. The first element in each defining pair is placed outside. For Table 1 we derive: A|B – C|D.

To test the consistency of seriation and orientation of A|B, A|C, and B|C for A – B – C, with AB < BC, we first write the three contingency tables (see Table 2).

Table 2 Contingency tables to test consistency of boundary orientation

[1]	*AC*	*CA*
AB	A	
BA	B	C

[2]	*BC*	*CB*
AB	A	
BA	B	C

[3]	*BC*	*CB*
AC	A, B	
CA		C

The last table shows two zero cells which lead to two solutions: A|C – B|C or C|A – C|B. Taking the first partial solution of [3], the order of the partial solutions from the three tables is consistent (see Table 3). One of the several axiomatizations of the betweenness relation may be used to test consistency routinely.

Table 3 Consistency demonstration

from [1]	A|B	-	A|C		
from [2]	A|B	-	-	-	B|C
from [3]			A|C	-	B|C
	A|B	-	A|C	-	B|C

This analysis corresponds to Feature Pattern Analysis (FPA, Feger 1994, Feger & Brehm 2001) and will now be applied to an example from Borg & Groenen (1997: 4).

Order by boundaries, illustrated by an example

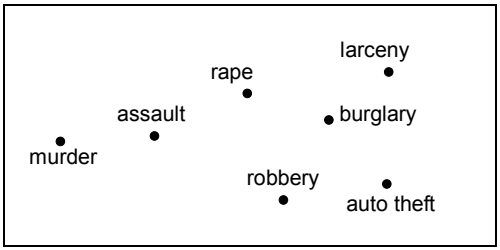
Table 4 reports from Borg & Groenen (1997: 4) the Pearson correlations between rates of different crimes over 50 US states (Wilkinson 1990). The ranks (with ties) of these coefficients are given below the main diagonal.

Table 4 Correlations between rates of different crimes (above main diagonal) / ranks of coefficients (below main diagonal)

		A	B	C	D	E	F	G
murder	**A**	-	.52	.34	.81	.28	.06	.11
rape	**B**	12.5	-	.55	.70	.68	.60	.44
robbery	**C**	16	10.5	-	.56	.62	.44	.62
assault	**D**	1	3.5	9	-	.52	.32	.33
burglary	**E**	19	5	6.5	12.5	-	.80	.70
larceny	**F**	21	8	14.5	18	2	-	.55
auto theft	**G**	20	14.5	6.5	17	3.5	10.5	-

Borg and Groenen provide in their Figure 1.1 a two-dimensional MDS representation of the correlations, see Table 4. We reproduce this solution in Figure 2.

Figure 2 Borg & Groenen solution for the correlations in Table 4



One may gain the impression that a part of the solution is one-dimensional: A – D – B – F. To test this assumption, we calculate all 15 contingency tables for these four elements. We find that all contain at least one zero cell. The order of the 6 boundaries is consistent, as graphed in Figure 3.

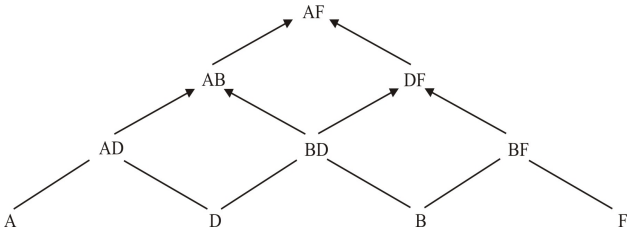
Figure 3 The one-dimensional order of four crimes

boundaries		A|D		D|B		A|B		A|F		D|F		B|F	
points	**A**	|	**D**	|		|		|	**B**	|		|	**F**

Figure 3 locates the points within their intervals. B has to be located between A|B and B|F. But referring to the information in Table 4, its position can be determined more precisely. The figure is not drawn to proportion, e.g. D – D|B ≠ B – B|D.

Quantitative information. Knowing the orientation of two boundaries towards each other one can derive a comparison of the relative length of two distances. The distance between the points defining the inner sides of the boundaries is smaller than the distance between the points defining the outer sides, e.g. for A|B – C|D, we derive that BC < AD. To test the consistency of this quantitative information, one may use the *Pyramid Criterion*. In the example with the sequence A – D – B – F as the qualitative solution, the adjacent intervals are AD, BD, and BF. Combining two adjacent intervals to a longer new one, containing both, we derive AD + BD = AB and BD + BF = DF. Finally, the extreme points define the longest distance. Figure 4 represents this as a graph.

Figure 4 Graph of the Pyramid Criterion for the A – D – B – F example



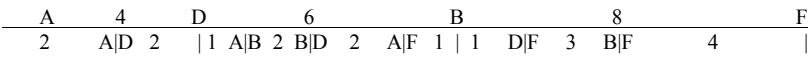
In Figure 4, AD → AB means AD < AB. Transitive closure is implied. Furthermore, if AD < BF then AB < DF because both, AB and DF, include BD and without it correspond to AD or BF. In the example, the distances satisfy the pyramid criterion with AB < DF and AD < BF.

We are now ready to construct the 'quantitative solution' by solving a set of equations and inequalities derivable from the qualitative solution in Figure 3 and the ranks in Table 4:

$$AD + BD = AB \quad (1)$$
$$BD + BF = DF \quad (2)$$
$$AD + BD + BF = AF \quad (3)$$
as side constraints: $AD < BD < \ldots < AF$

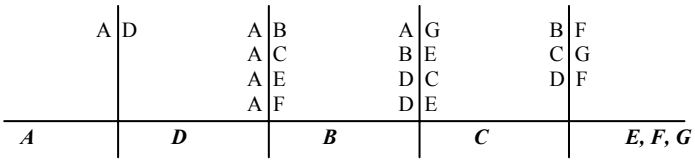
One solution is AD = 4, BD = 6, and BF = 8. The quantitative solution with these distances is given in Figure 5. The quantitative information in this figure is exact but the figure is not drawn to proportion. The upper part of Figure 5 shows the positions of the points and the interpoint distances. The lower part provides the location and orientation of the boundaries and the distances between the boundaries and between the points.

Figure 5 A quantitative solution for A – D – B – F



Even if, as in the crimes example, an acceptable **k** = 1 solution for all elements does not exist, one-dimensional *partial structures* may be found to support the interpretation. One of several such structures for the crimes data is shown in Figure 6.

Figure 6 A partial one-dimensional structure within a *k* = 2 solution



The first contrast, A|D, stresses that A (murder) is unique in comparison to all others. Closest to murder is assault. These two are different from all others, separated by four polarities: A to B (rape), to C (robbery), to E (burglary), and to F (larceny). One should not forget that this order is not based on similarity judgements but on common causes for the occurrence frequencies in the US states. Again, four contrasts separate A, D, and B from the others, all referring to violence against human beings versus violations of property rights.

Two-dimensional generalisation: trivariate contingencies

Again, from Figure 2 we hypothesize that the points for D = assault, B = rape, C = robbery, and E = burglary are arranged in two dimensions. If this is true, then either no zero cell exists in at least one contingency table, or the partial solutions derived from these tables are not consistent. We find that several tables require a **k** > 1 solution. Some of these tables are reported in Table 5.

Table 5 Contingency tables requiring *k* > 1

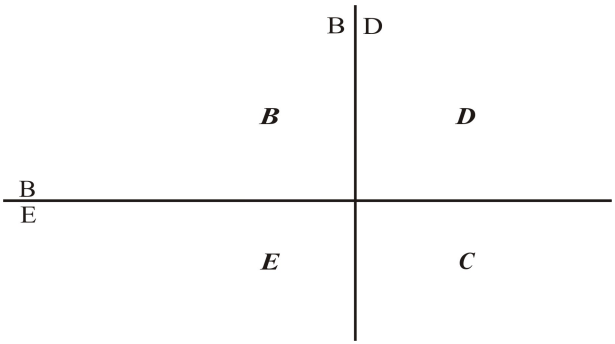
[1]	*BE*	*EB*
BD	B	E
DB	D	C

[2]	*CD*	*DC*
BD	E	B
DB	C	D

[3]	*DE*	*ED*
BD	B	E
DB	D	C

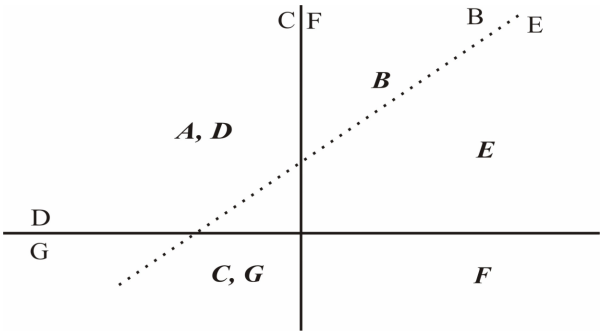
In **k** = 2, boundaries are separation *lines*. Two lines must intersect to provide four quasi-quadrants to locate each of the four points separately (see Figure 7, representing subtable [1] of Table 5).

Figure 7 Two separation lines locating four points



Referring to Table 5, it can be seen that some boundaries partition the points in the same way, e.g. B|C = D|C = D|E. We now turn to all points simultaneously. For N = 7 there exist 21 pairs of points. To every pair corresponds a boundary line, partitioning the set of all points into two sets. The sets are defined by their relative distances to the two points that define the boundary. Figure 8 shows the intersection of C|F and D|G. Then B|E is added to gain more information about the location of the seven points.

Figure 8 Intersection of boundary lines to locate all points



If such a map can be drawn without inconsistency, the combination of the three boundaries involved has passed the consistency test. Should such a test be failed, a way out would be to increase the number of dimensions. The information in Figure 8 can be written as a 2 x 2 x 2 contingency table (see Table 6). As before, BE means: The distance of the column point(s) to B is shorter than to E, etc.

Table 6 Contingency table for three boundaries

			points
BF	CF	DG	**A, D**
		GD	zero cell <1>
	FC	DG	**B**
		GD	zero cell <2>
FB	CF	DG	zero cell <3>
		GD	**C, G**
	FC	DG	**E**
		GD	**F**

This contingency table shows eight rows which are the cells of this table. In the example, three zero cells exist. They are represented as in the one-dimensional case with the first element defining a pair oriented outwards. The map in Figure 5 corresponds to zero cell <2>. The existence of more than one zero cell allows more than one representation or demonstrates a lack of uniqueness for the location of (too few?) points, given these boundaries. In general, the uniqueness increases rapidly with **N**.

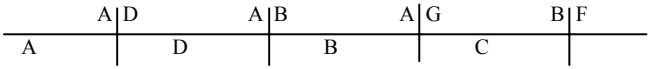
Without going into constructional details, we mention that not every intersection of three boundary lines leads to seven (isotonic) regions. If only three points define all three boundaries, as in A|B, A|C, and B|C, a closed region results corresponding to points with distances AB < BC, BC < AC, but AC < AB, an intransitive order. Unless one wants to represent intransitive choices, this region can be condensed to a point. This results in a star-like intersection of the three boundaries, corresponding to the intersection of mid-perpendiculars of a triangle in Euclidean space.

In the example depicted in Table 4, with N = 7, there exist 21 boundary lines A|B … F|G. Table 7 lists the partitions into two sets of elements that each line achieves.

Table 7 Partitions by boundary lines, crimes example

	boundary	*partition*	*comment*
(1)	A|B	A, D |B, C, E, F, G	same as A|C, A|E, A|F
(2)	A|D	A |B, C, D, E, F, G	
(3)	A|G	A, B, D |C, E, F, G	same as B|E, C|D, D|E
(4)	B|C	A, B, D, E, F |C, G	
(5)	B|D	A, C, D |B, E, F, G	same as C|E
(6)	B|F	A, B, C, D |E, F, G	same as C|G, D|F
(7)	B|G	A, B, D, F |C, E, G	
(8)	C|F	A, C, D, G |B, E, F	
(9)	D|G	A, B, D, E |C, F, G	
(10)	E|F	A, B, C, D, E, G |F	
(11)	E|G	A, B, C, D, E, F |G	
(12)	F|G	B, D, E, F |A, C, G	

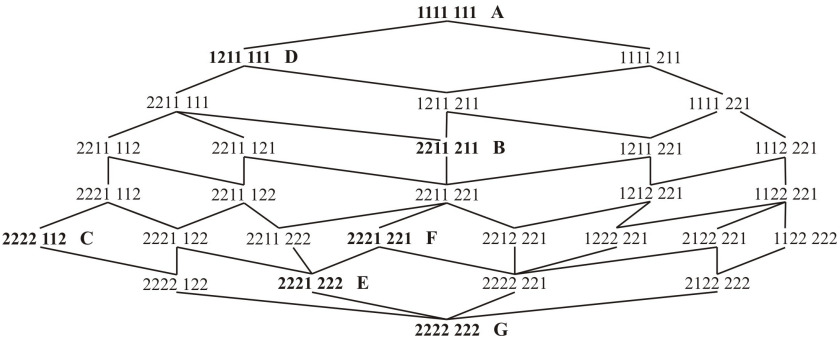
As Table 7 shows, only 12 out of 21 boundary lines provide a *unique* partition. For the *interpretation* of a solution, the fact that A|B and A|C lead to the same partitions provides the information that – as far as these data are concerned – the difference between murder and rape creates the same set structure among the elements as the difference between murder and robbery. Some lines may be drawn as pseudo-parallel, i.e., the data do not force these lines to intersect. In the example, several collections of such lines exist, hinting to one-dimensional substructures, as



The sets created by these partitions are *not* clusters as they are defined quite often in the literature, with the elements in a cluster being closer together and having longer distances to elements outside the cluster (Feger 2004).

A boundary line is not necessarily a mid-perpendicular bisector. Depending on the density distribution of the object points, a boundary line may separate the points in the same way as a mid-perpendicular bisector but the line is not in the same position as the bisector. From this viewpoint, one may *interpret a boundary line as a dichotomous item.* To perform an FPA, the crimes would be the data-generating cases. Taking only the 12 non-redundant boundary lines, this leads to a 12 x 7 matrix. One immediately sees the problem: too few cases. With a computer program, these data result in more than one hundred perfect two-dimensional solutions. Just for purposes of illustration, we report one solution with the first seven boundary lines in Figure 9. Note that this FPA-solution is compatible with the MDS-solution in Figure 2. The observed patterns (crimes) are printed bold. Could the other patterns in this solution – and they are the ones that differ between the solutions – be interpreted as other crimes?

Figure 9 An FPA solution with boundary lines as items



To the same 12 x 7 data matrix, other models can be fitted, e.g. HOMALS (see SPSS 12.0). The Eigenwerte of the first and second dimension are 0.408 and 0.307. The solution is very similar to the one in Figure 2, except for the position of D, e.g. with (ADBE).

Space as structured by distances between points

We now approach our problem from a different perspective (the discussion will compare the two approaches). Three distances are defined between three non-identical points. Without ties, one distance is the longest. If the points are collinear, the defining end points of the longest distance become the two extreme points, the third point is located *between* the other two. For each triple, this betweenness order can be derived. The properties of the one-dimensional betweenness relation (see, e.g. Fishburn 1985 for a review of axiomatizations) may be used to test consistency in the on-dimensional case.[1]

Let us briefly demonstrate the procedure for the crimes A, B, D, and F. The ranks of the proximities between these points are contained in Table 4. We derive

triple	*betweenness position*
ABD	A – D – B
ABF	A – B – F
ADF	A – D – F
BDF	D – B – F

leading to A – D – B – F. This is the same qualitative solution as in Figure 3, which was derived from the contingencies approach.

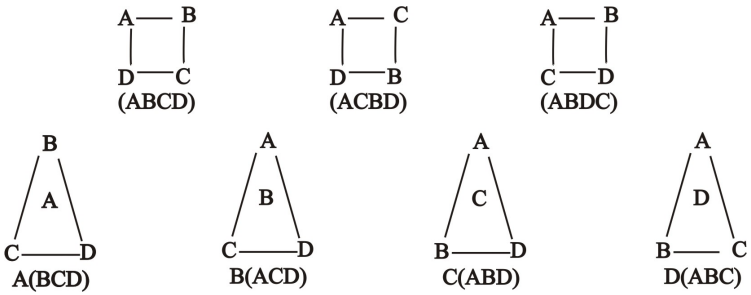
Two-dimensional generalization by using a multidimensional betweenness relation

We treat the multidimensional case by *generalizing the betweenness relation*. For **k** = 2, a point D is located between three other points A, B, and C if its position is on the same side of a line through A and B as point C, of a line through A and C as B, and on the same side of a line through B and C as A (see Figure 10).

On the plane, four points A … D may generate two topologically different configurations, either a (true) quadrilateral or a triangle with an inner point, i.e., one point between the other three points. Labeling the points, the seven configurations of Figure 10 result. This figure also reports the notational abbreviations of these configurations (see also Feger 2001).

1 written by Dipl. Math. Philip Metzner

Figure 10 All labeled configurations of four points in a plane



If the ranks of the six distances between these points are observed or derived, only some distance matrices are compatible with some configurations. Together with an extension to **k** = 3, Feger (1996) derived that

(1) any pair of two opposite sides of a quadrilateral is shorter than the sum of the two diagonals, and
(2) any two sides of a triangle are longer than those two inner lines originating from those end points which both triangle sides do not have in common.

For example in Figure 10, given (ABCD), we find (AB + CD) < (AC + BD) and (AD + BC) < (AC + BD). For A(BCD) one derives (BC + BD) > (AC + AD), (BC + CD) > (AB + AD), and (BD + CD) > (AB + AC). With these results, ranked distances can be used to identify the set of compatible configurations; their consistency can be tested by a constructive procedure to find the overall solution and will be presented below.

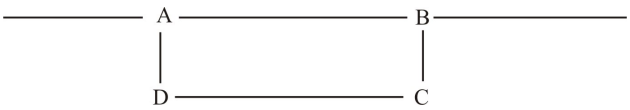
Testing for consistency (see Feger 2001). For the points A … E in Table 4 we list all compatible quadruple configurations in Table 8.

Table 8 Compatible configurations for A … E of Table 4

	quadruple	*configurations*		
		.1	.2	.3
1	ABCD	(ABCD)	D(ABC)	
2	ABCE	(ABEC)	B(ACE)	E(ABC)
3	ABDE	(ABED)	D(ABE)	
4	ACDE	(ADCE)	(ACED)	D(ACE)
5	BCDE	(BDCE)	B(CDE)	

For quadruple A, B, C, and D two compatible configurations are derived, to be numbered 1.1 and 1.2. The number of compatible configurations may differ from quadruple to quadruple. A solution consists of one configuration per quadruple. Thus, the number of combinations to be tested in this example is 2 x 3 x 2 x 3 x 2 = 72. While the sequence of this testing is irrelevant, we start with the combination of configurations 1.1, 2.1, 3.1, 4.1, and 5.1. Quadruple 1.1 corresponds to (ABCD). A line can be drawn through A and B extending this side of the quadrilateral. Then the remaining points C and D must be located on the same side – i.e., in the same half space – created by this line (see Figure 11).

Figure 11 The line through A and B creates two half spaces



The AB-line is also a part of 2.1 (ABEC). Here again, the points C and E have to be on the same side of this AB-line. Because C already is located on one side, C, D, and E must all be on this side, to be tested and confirmed by 3.1 (ABED). So the result of the first part of the consistency test is – [AB] C, D, E. In this example $\binom{N}{2} = \binom{5}{2} =$ 10 lines exist, each one to be used in the consistency test. For the line through A and C, we find

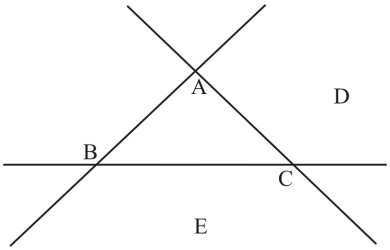
from	1.1	B [AC] D
	2.1	B, E [AC] –
	4.1	E [AC] D

and in the same way one derives

from	1.1	– [BC] A, D
	2.1	E [BC] A
	5.1	E [BC] D

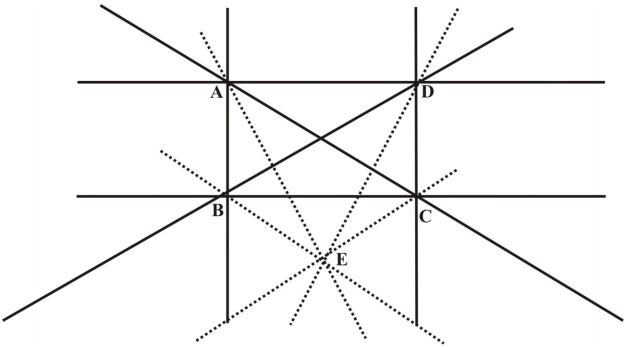
Together, and this reveals the constructive nature of this algorithm, we may draw Figure 12.

Figure 12 Integrating the results of the first three parts of the consistency test



The algorithm proceeds by using all lines and derives the solution in Figure 13, in which only the qualitative information counts.

Figure 13 One solution for A … E



The algorithm continues to find two more solutions (see Figure 14). All three qualitative solutions are in perfect agreement with the ranks of the distances. The first solution in Figure 14 is based on 1.2, 2.1, 3.1, 4.3, and 5.1, the second one on 1.2, 2.1, 3.2, 4.2, and 5.1. Being based on three identical configurations, their similarity is high; D is either located on the same side of line AE as C or as B.

Figure 14 Two more solutions for A … E

Comparing these solutions with Figure 13, (ABEC) is common to all three. The position of D is not well determined by this part of the data.

The analysis of the quadruple configurations can not only be used to construct a solution but allows a very *detailed study of the fit* between solution and data. Performing this analysis for the solution in Figure 2, two results are mentioned. (1) Identifying by inspection of Figure 2 the configurations implied, we note that most configurations in the solution are acceptable. Only one configuration violates the status of acceptability: We observe (ACGF), but (ACFG) would be acceptable, i.e., compatible with the ranks. For a solution with an almost perfect fit, it is not surprising that only one configuration does not correspond to the limitations provided by the data. (2) In Figure 2, point D is placed *on* the line between A and E. Our analysis indicates that D could be on either side. Thus, the solution in Figure 2 provides a 'compromise' of two equally acceptable qualitative solutions. The first contains D(ABE), (ADEC), D(AEF), and (ADEG,) while the second includes (ABED), D(ACE), (ADEF), and D(AEG). Thus, the quadruple analysis determines what is implied by the data – common over perhaps many equivalent solutions.

Facet theory. Schönemann & Borg (1983: 333) have emphasized that theoretical assumptions about the structure in the data should exist when performing MDS. One prominent possibility to relate the statistical analysis and the theoretical assumptions is facet theory. We illustrate one way to use quadruple configurations in $\mathbf{k} = 2$ for theory testing with a well known example of eight intelligence tests (Guttman 1965; see also Borg 1992; Borg & Groenen 1997: 73). The correlations between the tests are given in the lower triangular matrix of Table 9.

Table 9 Correlations between intelligence tests

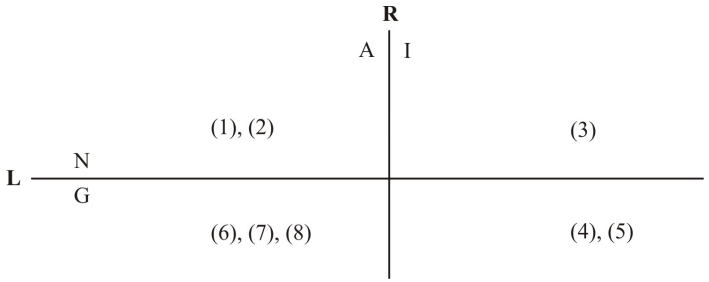
Tests	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
(1)	-							
(2)	.67	-						
(3)	.40	.50	-					
(4)	.19	.26	.52	-				
(5)	.12	.20	.39	.55	-			
(6)	.25	.28	.31	.49	.46	-		
(7)	.26	.26	.18	.25	.29	.42	-	
(8)	.39	.38	.24	.22	.14	.38	.40	-

The MDS solution for these data (Borg & Groenen, Figure 5.1) can be interpreted as being a circumplex. If this circular order exists in the data, every quadruple should exist in specific forms. For a circumplex without error with all points on a circle, e.g. the tests (1) … (4) should be represented by ((1)(2)(3)(4)). But the graph of the solution might suggest that test (6) deviates from a perfect simplicial structure. Testing the quadruple (4), (5), (6), and (7), one finds that the configuration compatible with the data is ((4)(5)(7)(6)) and not ((4)(5)(6)(7)), as demanded by a perfect circumplex. Furthermore, the quadruple analysis reveals that (4) or (5) or (6) may be between the remaining object points of this quadruple.

We conclude that the circumplex is not perfect and that the deviation of (6) is real and could deserve an explanation. We did not report the analysis of all 70 quadruple configurations. This is not necessary to reach the conclusions above, because if the acceptable configurations for A, B, C, and D do not contain the theoretically predicted one, no analysis including further object points E … N changes the list of acceptable forms for A … D. In this sense, the list of acceptable configurations for A … D is *independent* of any other list of quadruples from A … N. If a hypothesis is related to a subset of points, it suffices to analyze this subset. By the way, the solution reported in the literature is not totally supported by the data, e.g. ((4)(5)(6)(8)) does not exist. The quadruple analysis suggested here allows to pinpoint all deviations of a solution from the data.

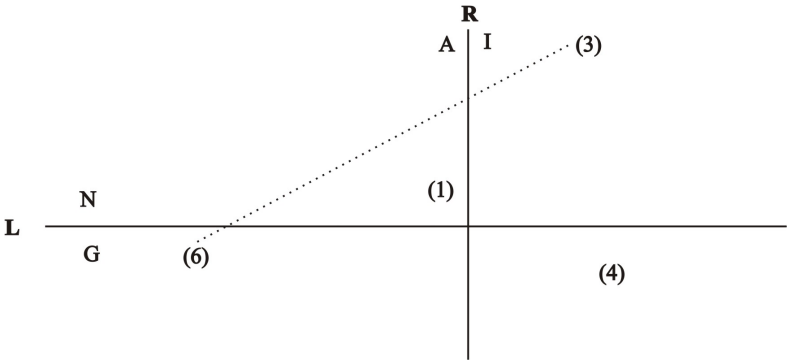
On the other hand, the eight tests are ordered by two facets, *language* **L** with N = numeric and G geometrical, and *requirement* **R** with A = application and I = inference. These two facets may be conceptualized and represented as boundary lines. Their intersection is provided in Figure 15.

Figure 15 Coding of the intelligence tests with respect to two facets



It is evident that all configurations maintaining the positions of the quadrants like ((1)(3)(4)(6)) or ((2)(3)(5)(8)) provide empirical support for the hypothesized facet structure. A configuration violating the clockwise (or anti-clockwise) order of the quadrants like ((1)(4)(3)(6)) would violate the assumed order. But the information that (1) is placed in the quadrant defined by N and A does not place (1) in an exact geometrical position. It is not against the information if (1)((3)(4)(6)) is derived from the data (see Figure 16). Thus, the violating cases are only quadrilaterals with diagonals against the quadrant order.

Figure 16 A betweenness position of test (1) compatible with the facet structure



Quantification. To demonstrate the quantification, given a qualitative solution, we select the crimes A … E and re-rank their distances in Table 10 (taken from Table 4).

Table 10 Re-ranked distances between crimes A … E

	A	B	C	D	E
A	-				
B	7.5	-			
C	9	6	-		
D	1	2	5	-	
E	10	3	4	7.5	-

We chose the first solution in Figure 14 for the demonstration, with D(ABC), (ABEC), D(ACE), and (BDCE) as the defining quadruples. For each quadruple configuration, we derive inequalities, e.g. for D(ABC) we derive (see paragraph 5 of this paper):

$$({}^{1}\mathrm{AD} + {}^{2}\mathrm{BD}) < ({}^{9}\mathrm{AC} + {}^{6}\mathrm{BC}),$$
$$({}^{1}\mathrm{AD} + {}^{5}\mathrm{CD}) < ({}^{6}\mathrm{BC} + {}^{7.5}\mathrm{AB}),$$
$$({}^{2}\mathrm{BD} + {}^{5}\mathrm{CD}) < ({}^{7.5}\mathrm{AB} + {}^{9}\mathrm{AC}).$$

Each of these three inequalities is trivial in the sense that for each rank in the smaller sum a larger rank exists – in a one to one assignment – in the larger sum. This observation helps to reduce the number of inequalities which increases very much with an increasing number of elements (crimes). These trivial inequalities are satisfied by the side constraints corresponding to the ranks as observed in Table 10: ${}^{1}\mathrm{AD} < {}^{2}\mathrm{BD} < \ldots < {}^{9}\mathrm{AC} < {}^{10}\mathrm{AE}$. Of all inequalities derived from the quadruple configurations, only

$$({}^{7.5}\mathrm{AB} + {}^{7.5}\mathrm{DE}) < ({}^{10}\mathrm{AE} + {}^{2}\mathrm{BD})$$

is not trivial in the sense defined above and has to be taken into account when calculating the quantitative solution. Furthermore, to obtain metric distances, for every triple A, B, and C the triangular inequality has to be satisfied. For A, B, and C, with AC as the largest distance in Table 10, one requires $\mathrm{AC} \leq \mathrm{AB} + \mathrm{BC}$. Table 11 gives one of many possible sets of distances satisfying all constraints.

Table 11 Distances between A … E

	A	**B**	**C**	**D**	**E**
A	-				
B	24	-			
C	26	22	-		
D	13	14	20	-	
E	37	16	18	25	-

We did not prove that the conditions and constraints imposed on the distance estimates are sufficient. Therefore, we test the realizability of a two-dimensional representation of the distance estimates in Table 11 by applying MDS. Using PROCSCAL of SPSS 12.1 with a ratio transformation of the dissimilarities in Table 11, we obtained a normalized raw stress = 0.0011 and an explained variance of 0.99889. This corresponds as close as possible to the perfect fit to be expected in this analysis. The solution shows the correct forms of the quadruple configurations. The coordinates of the crimes A … E are provided in Table 12.

Table 12 Coordinates of A … E in the plane

	dimension	
	1	**2**
A	.845	-.029
B	-.142	.422
C	-.257	-.542
D	.330	.055
E	-.776	.095

Searching for an ‘optimal’ solution for data with error

For researchers applying MDS and aiming at a low dimensional solution, usually only solutions with some error or ‘unexplained variance’ exist, but not with a perfect fit between model and data. Sometimes, it is meaningful to assume that random error has distorted the size of the proximities and their ranks. Most conceptualizations of random error imply that small errors are more probable or frequent than large ones. For ranks, this means that the exchange of adjacent ranks (the first becomes the second, while the second becomes the first) should lead frequently to a dissolving of error, while the exchange of more distant ranks may not as often be necessary to find a solution.

We search for a solution with an optimal fit to the data. Of course, several definitions of 'optimal fit' can and have been given – implied in every optimization algorithm and choice of a loss function (see Borg & Groenen 1997). Our approach compares the distance ranks implied by a solution to those observed. We start by changing the observed distance ranks as little as possible. This we define in accordance with Kendall's τ as the number of exchanges or permutations between adjacent ranks. Kendall (1948) used the statistic **S** defined as the minimum number of exchanges of adjacent elements necessary to transform one rank order into another one. We illustrate our procedure with the ranks provided in Table 13.

Table 13 Distance ranks to demonstrate the approximation matrix

	A	**B**	**C**	**D**
A	-			
B	3	-		
C	1	5	-	
D	4	2	6	-

For these data, no perfect one-dimensional solution exists. With N objects and $\binom{N}{2}$ distances, there exist $\binom{N}{2}-1$ pairs of ranks of adjacent distances. For the example of Table 13 we derive this list of exchanges with **S** = 1:

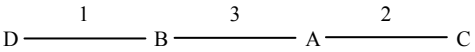
	observed	*transformed*
[1]	^{1}AC, ^{2}BD,	^{2}AC, ^{1}BD.
[2]	^{2}BD, ^{3}AB,	^{3}BD, ^{2}AB.
[3]	^{3}AB, ^{4}AD,	^{4}AB, ^{3}AD.
[4]	^{4}AD, ^{5}BC,	^{5}AD, ^{4}BC.
[5]	^{5}BC, ^{6}CD,	^{6}BC, ^{5}CD.

We write the rank of a distance as an exponent to the left. ^{1}AC means that AC has rank 1, signifying the shortest distance. For each of the five exchanges with **S** = 1, we test whether a **k** = 1 solution exists. After exchange [1], we derive the ranks in Table 14.

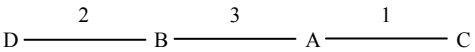
Table 14 Distance ranks after exchange [1]

	A	**B**	**C**	**D**
A	-			
B	3	-		
C	2	5	-	
D	4	1	6	-

From the ranks in Table 14 and the triples B – A – C, A – B – D, C – A – D, and C – B – D, we construct the quantitative solution

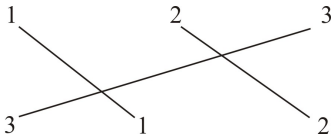


This solution perfectly fits the ranks in Table 14, and approaches with **S** = 1 as close as possible the ranks in Table 13. Because there may exist more solutions with **S** = 1, i.e., the same optimal fit, we test the effects of all exchanges [1] … [5]. For exchange [2] we find the same solution as for [1], noting that slightly different rank matrices may lead to identical solutions. Exchanges [3] and [5] do not provide a solution, but [4] produces



agreeing with the first solution qualitatively but not with respect to the quantification.

As far as the example is concerned, this would end the search for optimal solutions. In general, larger exchanges than **S** = 1 will be considered, first those with **S** = 2. These exchanges are generated by combining two **S** = 1 exchanges, e.g. [1] with [2], [1]with [3], etc. from the list above. Furthermore, **S** = 2 is created by a permutation of the type: from 1 – 2 – 3 to 3 – 1 – 2, illustrated as two intersections of the lines connecting the same ranks:



Discussion

Using the perspectives as emphasized by Schönemann & Borg (1983), we here describe and discuss the contributions of this paper with respect to the existence, uniqueness, and interpretation of nonmetric MDS solutions for ordinal data. Two formal approaches are outlined. The first one uses *contingencies* and, as the geometrical realization, *boundaries* between object points. The second approach applies the *generalized betweenness relation*. The geometrical correspondence is the seriation in a triple in **k** = 1 and the *quadruple configuration* in **k** =2. For both approaches, procedures and examples in the one- and two-dimensional case are provided.

Starting with **k** = 1 for the contingency approach, the *existence* of a solution depends on the existence of at least one zero cell per contingency table, and on the consistency of the zero cells. This leads to a qualitative solution in the sense of Coombs, with incomplete information on the (relative) size of the distances between object points. The existence of a quantitative solution requires the solvability of a system of equations and inequalities. To test this, the 'Pyramid Criterion' is introduced.

Using an equation system to find scale values meets some reservations (see Krantz et al. 1971, in particular chapter 9). Indeed, a larger system of empirically derived equations rarely is without a contradiction, rendering the whole system not solvable. General approximation procedures are available, e.g. Mathcad (2001) with the option *'minerr'*.

One may use the algorithm of Feature Pattern Analysis to find all qualitative and quantitative solutions. The scale level of the quantitative solutions approaches the interval scale with an increasing number of objects rather rapidly. Thus, the question of uniqueness is answered by listing all solutions compatible with the data and the acceptability criteria of the researcher.

For the interpretation of a solution, the concept of a boundary may be called upon. Such a boundary point or line or plane exists for every pair of object points and correspondents – substantially interpreted – to a *contrast* between the two objects defining this boundary. In the crimes example, some boundary lines express the difference between crimes with violence against human beings vs. violations of property rights.

In the *two-dimensional case,* zero cells in trivariate contingency tables establish the necessary conditions for the existence of solutions. The structure implied by each zero cell must be compatible with the structure postulated by every other zero cell. Again, each pair of object points creates a boundary line, which now may intersect with other lines in the plane to create regions for the location of the object points. A boundary line may be inter-

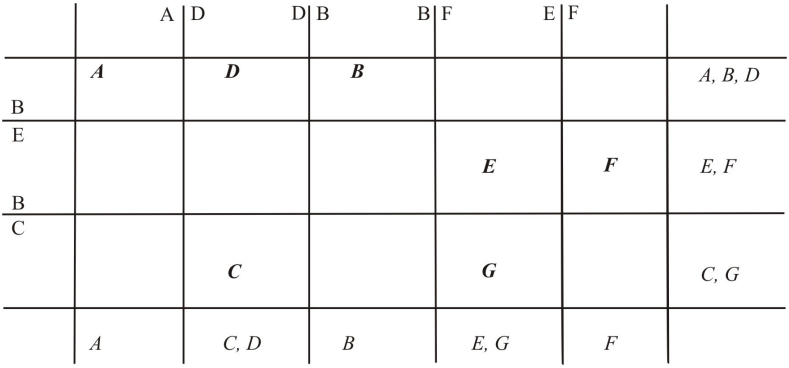
preted as an item to be analyzed by procedures such as FPA or HOMALS. As in the one-dimensional case, all qualitative and quantitative solutions of a desired fit can be found.

The second approach, using proximity ranks in a one- or multidimensional *betweenness relation,* orders in **k** = 1 all triples of object points according to one of the various betweenness axiomatizations, and if that is possible simultaneously for all object points, a qualitative solution exists. The quantitative solution can be found in the same way as for the first approach. For the interpretation, each triple stipulates a comparison of the middle or central element with the two outer ones: The climate in the Netherlands (NL) differs from those of Sweden (S) and Portugal (P), but S and NL as well as P and NL have more or perhaps more important properties in common than S and P.

The two-dimensional case introduces the powerful concept of the *quadruple configuration.* Two topological variants exist in **k** = 2. The quadrilateral represents four object points, none of which is located between the others. The triangle with an inner point represents one object point between the other three. For more than four points, one may differentiate between the hull and the kernel of the constellation of points. Multiple imbedding of hulls and kernels allows for a detailed substantial interpretation. In Figure 2, for example, D (assault) and E (burglary) are contained in or surrounded by all other points, forming a hull for them. E also is contained in D, F, and G. With more points, the number of (relative) hulls with their kernels, forming overlays, tunnel, and other structures, provide a rich basis for interpretation, as the lines of the contingency approach do.

The positioning of co-ordinate axes is arbitrary, as in most MDS models. To support a dimensional substantial interpretation in **k** = 2, one of many possibilities is to use two sets of boundary lines. Each set intersects (only) with the other one. The sets should partition the point localizations in two different ways. These partitions should be as independent as the data allow. Independence may be defined, e.g. by Kendall's τ. Figure 17 reports one of many possibilities for the crimes data. The partitions in the last row and the last column (with many ties) correlate $\tau_b = 0.344$, which is not significant.

Figure 17 A two-dimensional representation of the crimes example



The two approaches lead to the same results, while using different ways. From the contingencies, zero cells are derived and geometrically realized as a set of boundaries (see Figure 1). From pairs of boundaries, one may then derive the positions of the object points in one of the regions. Quantitative information is provided by a zero cell as well. Using the betweenness relation on the distances, triple (in **k** = 1), quadruple (in **k** = 2) or quintuple configurations (**k** = 3; a tetrahedron with an inner point or two tetrahedra with a common triangular base) are the analytical units to be used when constructing a spatial representation. While the configurations immediately provide the localizations of the object points, the positions of the boundaries can be derived from them. Thus, in a different sequence, both approaches offer the same information on the location of points and of boundaries, starting both from ordinal data.

There exist, of course, other possibilities to provide a mathematical foundation for MDS. For metric MDS, several bases are already given (see Mathar 1997). Borg & Groenen (1977: 16) offer a "ruler-and-compass approach to ratio MDS". The assumed properties of the data require different approaches. Other achievements are discussed in Schönemann & Borg (1983).

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MULTIDIMENSIONAL SCALING WITH REGIONAL RESTRICTIONS FOR FACET THEORY: AN APPLICATION TO LEVY'S POLITICAL PROTEST DATA

PATRICK J.F. GROENEN & IVO A. VAN DER LANS

Abstract: *Multidimensional scaling (MDS) is often used for the analysis of correlation matrices of items generated by a facet-theory design. The emphasis of the analysis is on regional hypotheses on the location of the items in the MDS solution. An important regional hypothesis is the axial constraint, where the items from different levels of a facet are assumed to be located in different parallel slices. The simplest approach is to do an MDS and draw the parallel lines separating the slices as good as possible by hand. Alternatively, Borg & Shye (1995) proposed to automate the second step. Borg & Groenen (1997, 2005) proposed a simultaneous approach for ordered facets, when the number of MDS dimensions equals the number of facets. In this paper, we propose a new algorithm that estimates an MDS solution subject to axial constraints without the restriction that the number of facets equals the number of dimensions. The algorithm is based on constrained iterative majorization of De Leeuw & Heiser (1980) with special constraints. This algorithm is applied to Levy's (1983) data on political protests.*

Introduction

Multidimensional scaling (MDS) has long been an important technique for analyzing data obtained with facet theory (FT, see, for example, Borg & Shye 1995). Amongst other areas, Ingwer Borg has been advocating these two methods as useful tools for theory building and data analysis. A strong point of FT is the careful design by which items are constructed. Often, correlations between these items are visualized by MDS. Consider Table 1 that shows a dissimilarity matrix $\mathbf{\Delta}$ and a facet design of three facets. In practical facet-theory applications, the dissimilarities are often transformed correlations r_{ij} between items: $\delta_{ij} = 1 - r_{ij}$. The facets can be viewed as categorical design variables on the items of

the analysis. The first facet in Table 1 divides the items into three different categories, the second facet into two categories and the third into three. Thus, every item *j* belongs to a single category on each of the three facets. In facet theory, it is typically postulated that the facets imply particular structures on the empirical intercorrelations, and that these structures will be reflected by regional hypotheses in the MDS solution. Each facet is assumed to partition the MDS space into regions in one of three manners (see Figure 1): by an *axial* partitioning (division into slices along a line), a modular partitioning (division into concentric bands) or a polar partitioning (division into pie pieces), see Guttman (1959), Borg & Shye (1995), and Borg & Groenen (1997, 2005). Note that the lines in Figure 1 are drawn by hand. In this paper, we limit ourselves to axial partitioning only.

Figure 1 Three ways of partitioning the MDS space for a three level facet

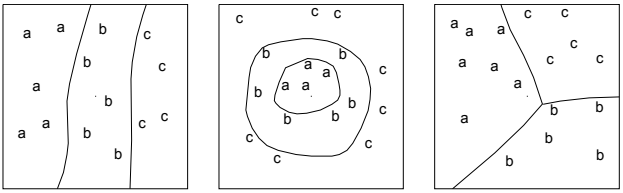


Table 1 Example of a dissimilarity matrix Δ and a three facet design

Dissimilarity matrix **Δ**

	I_1	I_2	I_3	⋯	I_{n-1}	I_n
I_1	0					
I_2	δ_{12}	0				
I_3	δ_{13}	δ_{23}	0			
⋮	⋮	⋮	⋮	⋱		
I_{n-1}	$\delta_{1,n-1}$	$\delta_{2,n-1}$	$\delta_{3,n-1}$	⋯	0	
I_n	δ_{1n}	δ_{2n}	δ_{3n}	⋯	δ_{2n}	0

Facet design

	Facet 1	2	3
I_1	a	a	c
I_2	a	b	c
I_3	b	a	c
⋮	⋮	⋮	⋮
I_{n-1}	c	b	a
I_n	c	b	a

Given some MDS solution, the construction of the regions is most often done subjectively by the researcher and not through a standardized computational method. A first step towards imposing regions automatically was proposed by Borg & Shye (1995) who provided a two step procedure: first do an MDS followed by finding an optimal location of the lines separating the categories of a facet. In Borg & Groenen (1997, 2005), a simultaneous approach was proposed that searched for an MDS solution that is constrained such that the levels of a facet are linearly separated. The advantage of this approach is that only theory-consistent MDS solutions are considered and that the program Proxscal in SPSS (Meulman, Heiser & SPSS 1999) can handle these constraints. However, the application of the simultaneous approach is limited to situations in which the number of dimensions is the same as the number of facets. Furthermore, Proxscal only works for ordered facets.

In this paper, we propose a Multiple Axial-wise Partitioning Constraints MDS model (MAPC). The MAPC MDS model makes it possible to incorporate axial facet constraints in the construction of the MDS map. An important characteristic of our MAPC MDS model is that it is able to handle situations in which there are more constraining facets than dimensions, so that the dimensionality and therefore the complexity of the interpretation of the MDS map can be kept at a minimum. In addition, MAPC MDS can handle unordered facets as well.

This paper is organized as follows. First, we introduce the main ideas of regional constraints in MDS using axial partitioning. Then, we derive the MAPC MDS algorithm and apply the method to data of Levy on political protests. We end the paper with some conclusions.

Multiple axial-wise partitioning constraints

We propose a multiple axial-wise partitioning constrained MDS for the analysis of data obtained by facet-theory design that is able to deal with more (categorical) facets than dimensions. The basic idea underlying the MAPC model is that we require the MDS solution to be partitioned into successive slices for each facet. Items from different levels of facets are required to lie in different slices, whereas items from the same level are required to lie within the same slice. The hyperplanes separating the slices corresponding to a single facet are parallel to each other, which implies that they are orthogonal to one particular direction in the MDS space.

Table 2 Example of a facet design H

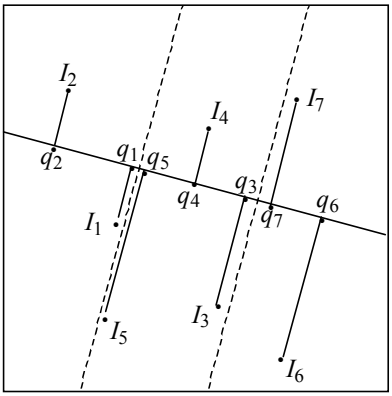
	$\mathbf{h}_1$	$\mathbf{h}_2$	$\mathbf{h}_3$
I_1	1	1	2
I_2	1	2	2
I_3	2	1	3
I_4	2	2	1
I_5	2	1	3
I_6	3	1	3
I_7	3	2	1

Consider the small example of $m = 3$ facets in the $n \times m$ matrix **H** in Table 2. Let us focus on the first facet $\mathbf{h}_1$ which has three levels. Assume for the moment that this facet is ordered, that is, the axial hypothesis implies that the items are located in subsequent parallel regions that are ordered along a line according to the order of the levels. Because the regions are parallel, two adjacent regions representing adjacent levels of the facet $\mathbf{h}_1$ are separated by parallel hyperplanes that form parallel lines in 2D. Orthogonal to these separation hyperplanes, a line exists such that the orthogonal projection of the items onto that line satisfy the set of inequalities

$$q_1, q_2 \leq q_3, q_4, q_5 \leq q_6, q_7. \tag{1}$$

Figure 2 shows an MDS solution that is consistent with facet $\mathbf{h}_1$ treated ordinally. Any MDS solution for which the projections of the items on some line in the MDS space satisfy (1) yields an axial partitioning for the ordinal facet $\mathbf{h}_1$.

Figure 2 **Example of an axial partitioned MDS space where the items of three levels are separated by an axial partitioning. The projections q_i of the items on the line orthogonal to the dashed separation lines satisfy the set of inequalities in (1)**



What if the regions of the facet are not ordered, that is, if the levels of the facet are treated ordinally? Then, any permutation of the labels of $\mathbf{h}_1$ is equally good. Therefore, for a facet $\mathbf{h}_1$ with three levels there are six admissible projections on the line:

$$
\begin{array}{lll}
q_1, q_2 & \leq q_3, q_4, q_5 & \leq q_6, q_7 \\
q_1, q_2 & \leq q_6, q_7 & \leq q_3, q_4, q_5 \\
q_6, q_7 & \leq q_1, q_2 & \leq q_3, q_4, q_5 \\
q_6, q_7 & \leq q_3, q_4, q_5 & \leq q_1, q_2 \\
q_3, q_4, q_5 & \leq q_1, q_2 & \leq q_6, q_7 \\
q_3, q_4, q_5 & \leq q_6, q_7 & \leq q_1, q_2.
\end{array}
$$

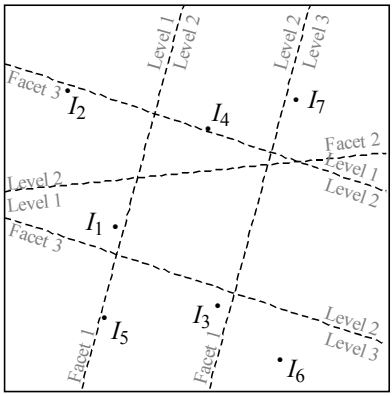
For such a nominal facet, we one can run MDS subject to all six orders and retain the best solution.

In terms of matrix algebra, we can specify multiple axial constraints as follows. Let **X** be the $n \times p$ matrix of coordinates of n items in p dimensions. For multiple facets, let **Q** be the $n \times m$ matrix with the projections for each of the m facets. Then, the coordinates **X** are restricted by

$$\mathbf{X} = \mathbf{QC} \tag{2}$$

subject to rank of **Q** is p and **C** is an $m \times p$ matrix. The combination of the inequality restrictions such as (1) and the rank p restriction on **Q** ensures that the regional constraints of all facets are simultaneously satisfied. Figure 3 shows an example of an MDS solution where the items satisfy the restrictions of the multiple axial regions for the three facets in Table 2.

Figure 3 **A multiple axial partitioned MDS space satisfying the axial partitioning restrictions imposed by the three facets in Table 2. The dashed lines are the separation lines**



Note that not all combinations of the levels of the three facets are present in Table 1, as there are seven items with different combinations of facet levels out of a possible number of $3 \times 2 \times 3 = 18$ different combinations. Yet Figure 3 allows us to reconstruct 14 different regions, of which only 13 are visible in the figure, that correspond to 14 combinations of

the three facet levels. The location of a level-separation line is uniquely determined only when projections of at least two items from each of the levels onto the characteristic's vector coincide. If that is not the case, then there is still some freedom left. Instead of level-separation lines, we will have level-separation regions. As the number of levels within a facet increases or the number of facets increase, then there is usually not much freedom left to place the separation line.

The Stress function of MDS can be very flat near the (local) minimum, or can have various similar local minima for completely different configurations (Borg & Lingoes 1980). The idea behind constrained MDS methods in general is that constrained configurations can be interpreted in terms of the external information (constraining attributes), with possibly an only slightly lower fit than the unconstrained configurations. That is, we may get a more easily to interpret configuration without having to offer too much precision in the representation of preferences or dissimilarities. In practice, it is advisable to always compare MAPC-constrained MDS configurations with their unconstrained counterparts.

An algorithm for imposing MAPC in MDS

The multiple axial partitioning constraints do *not* operate on each dimension separately. Instead, coordinates on one dimension affect the feasible set of coordinates on other dimensions. As a consequence of the dependency of dimensions with respect to the constraints, MDS with multiple axial partitioning constraints can not be computed by simple extensions of previously proposed algorithms for other constrained MDS methods, like MDS with dimension-wise order constraints on the coordinates (see Heiser & Meulman 1983; Borg & Groenen 1997) and dimension-wise monotone-spline constraints as proposed by Winsberg & De Soete (1997). Nor can MAPC MDS be implemented by existing algorithms for MDS methods that do impose constraints simultaneously on all dimensions, like MDS with constraints on interpoint distances (Skarabis 1978; Borg & Lingoes 1980), with “circle constraints” (Borg & Lingoes 1980; De Leeuw & Heiser 1980), more general equality and inequality constraints (Lee 1984), configuration-size constraints (Mathar 1990) or reduced-rank subspace constraints for subsets of objects (Borg 1977).

For finding MDS solutions under multiple partitioning constraints, we use the iterative majorization algorithm of De Leeuw & Heiser (1980), called SMACOF. Their iterative majorization algorithm minimizes the following weighted least squares Stress function

$$\sigma^2(\mathbf{X}) = \sum_{j=1}^{n} \sum_{i=j+1}^{n} w_{ij} \, (\delta_{ij} - d_{ij}(\mathbf{X}))^2 \qquad (3)$$

under any set of constraints, by finding a series of constraints-satisfying configurations with monotonically decreasing Stress values. In (4), $d_{ij}(\mathbf{X})$ is the Euclidean distance between objects i and j in a p-dimensional space, whose coordinates are given in rows i and j of the $n \times p$-configuration matrix $\mathbf{X}$ and w_{ij} is a fixed (nonnegative) weight that weights the contribution of the squared residual of object pair (i,j) to the overall Stress. Instead of $\sigma^2(\mathbf{X})$, we report $\sigma_n^2(\mathbf{X}) = \sigma^2(\mathbf{X}) \Big/ \sum_{j=1}^{n} \sum_{i=j+1}^{n} w_{ij} \delta_{ij}^2$, which has the same local minima and the advantage that at a local minimum $\sigma_n^2(\mathbf{X})$ values are always between 0 and 1 and are equal to the square of Kruskal's (1964) Stress-1 (see, Borg & Groenen 2005: 249–250).

In case of MDS for the analysis of intercorrelations between items from a facet design, the n objects correspond to the n items and all w_{ij}'s are larger than 0 (usually equal to 1), unless the intercorrelations for some pairs (i,j) are missing, in which case their associated weights become 0. The summation in (3) is across all lower-diagonal elements of the matrix of dissimilarities $\mathbf{\Delta}$ only, because this matrix is assumed to be symmetric.

In each step of the iterative majorization algorithm, a better constrained configuration is found by constructing a function $\varphi(\mathbf{X},\mathbf{X}^*)$ that majorizes $\sigma^2(\mathbf{X})$, and by minimizing $\varphi(\mathbf{X},\mathbf{X}^*)$ over $\mathbf{X}$. A function $\varphi(\mathbf{X},\mathbf{X}^*)$ is said to majorize function $\sigma^2(\mathbf{X})$, when $\sigma^2(\mathbf{X}) \leq \varphi(\mathbf{X},\mathbf{X}^*)$ for all $\mathbf{X}$, and $\varphi(\mathbf{X},\mathbf{X}^*) = \sigma^2(\mathbf{X})$ when $\mathbf{X} = \mathbf{X}^*$. Let $\hat{\mathbf{X}}$ be the constrained $\mathbf{X}$ that minimizes $\varphi(\mathbf{X},\mathbf{X}^*)$ for some $\mathbf{X}^*$, then we have the following set of (in)equalities:

$$\sigma^2(\hat{\mathbf{X}}) \leq \varphi(\hat{\mathbf{X}},\mathbf{X}^*) \leq \varphi(\mathbf{X}^*,\mathbf{X}^*) = \sigma^2(\mathbf{X}^*)$$

Clearly, choosing $\mathbf{X}^*$ to be equal to the constrained configuration obtained in the previous iteration and minimizing $\varphi(\mathbf{X},\mathbf{X}^*)$ over $\mathbf{X}$ subject to the constraints, we obtain a constrained configuration with lower (or equal) Stress in each iteration. $\mathbf{X}^*$ is called a support-

ing point of the majorizing function. Because the series of Stress values of successive constrained configurations is monotonically decreasing and the Stress is bounded from below by zero guarantees that the algorithm will converge to at least a local minimum. For more information on iterative majorization, see, for example, De Leeuw (1994), Heiser (1995) or, for an introduction, Borg & Groenen (2005).

Majorization is useful when a complicated function, like $\sigma^2(\mathbf{X})$ can be majorized by a simpler function. A relatively quadratic function in $\mathbf{X}$ that majorizes $\sigma^2(\mathbf{X})$ is

$$\begin{aligned}\varphi(\mathbf{X},\mathbf{X}^*) &= \sum_{j=1}^{n}\sum_{i=j+1}^{n}\left(w_{ij}\delta_{ij}^2 - 2b_{ij}(\mathbf{X}^*)(\mathbf{x}_i - \mathbf{x}_j) + w_{ij}d_{ij}^2(\mathbf{X})\right)\\ &= c_1 + \|\mathbf{X} - \mathbf{V}^-\mathbf{B}(\mathbf{X}^*)\mathbf{X}^*\|_{\mathbf{V}}^2,\end{aligned}$$

where

$\mathbf{x}_i$	is the p-vector containing elements from the i^{th} row of $\mathbf{X}$,
$b_{ij}(\mathbf{X}^*)$	$= w_{ij}\delta_{ij}/d_{ij}(\mathbf{X}^*)$, if $d_{ij}(\mathbf{X}^*) > 0$, and
$b_{ij}(\mathbf{X}^*)$	$= 0$, if $d_{ij}(\mathbf{X}^*) = 0$,
$\|\mathbf{Z}\|_{\mathbf{V}}^2$	denotes the weighted squared Euclidean norm given by tr $(\mathbf{Z}'\mathbf{V}\mathbf{Z})$,
$\mathbf{V}$	is an $n\times n$-matrix, whose elements v_{ij} are equal to $-(w_{ij}+w_{ji})$ if $i \neq j$, and whose elements v_{ii} are equal to $\sum_{j\neq i} w_{ij}$,
$\mathbf{V}^-$	is a generalized inverse of $\mathbf{V}$,
$\mathbf{B}(\mathbf{X}^*)$	is the $n \times n$ matrix with elements $-b_{ij}$ if $i \neq j$ and $\sum_{j\neq i} b_{ij}$ if $i = j$,
c_1	is a constant that depends on $\mathbf{X}^*$.

The unconstrained $\mathbf{X}$ that minimizes $\varphi(\mathbf{X},\mathbf{X}^*)$ which we will refer to by $\overline{\mathbf{X}}$, that is equal to $\mathbf{V}^-\mathbf{B}(\mathbf{X}^*)\mathbf{X}^*$. The constrained $\mathbf{X}$ that minimizes $\varphi(\mathbf{X},\mathbf{X}^*)$ can be found by projecting $\overline{\mathbf{X}}$ onto the multiple axial constraints in the metric defined by $\mathbf{V}$.

In the previous section, we stated that the multiple axial partitioning constraints can be imposed by requiring $\mathbf{X} = \mathbf{QC}$ such that $\mathbf{q}_k$ satisfies the partitioning constraints of each

facet k and $\mathbf{Q}$ being of rank p. To avoid the possibility that some $\mathbf{q}_k = \mathbf{0}$, we also impose additionally the constraint $\|\mathbf{q}_k\|^2 = n$. These restrictions are equivalent to $\mathbf{X} = \mathbf{ZA'C}$ subject to the constraints $\mathbf{Za}_k \in C_k$ and $\|\mathbf{Za}_k\|^2 = n$. Here,

$\mathbf{Z}$	is an $n\times p$-matrix of to be estimated parameters,
$\mathbf{A}$	is an $m\times p$-matrix of to be estimated parameters,
$\mathbf{a}_k$	is the m-vector containing the elements from the kth row of $\mathbf{A}$,
$\mathbf{C}$	is an $m\times p$-matrix of to be estimated parameters, and
C_k	is the closed convex cone that denotes the inequality constraints that are implied by the kth level.

So, the matrix $\mathbf{A}$ defines directions in the p-dimensional space given by $\mathbf{Z}$. Writing $\mathbf{X}$ in terms of $\mathbf{ZA'C}$ and imposing constraints on the columns of $\mathbf{ZA'}$ guarantees that the directions given by $\mathbf{C'(CC')}^-$ in the p-dimensional space given by $\mathbf{X}$ satisfy the constraints. The constraints $\|\mathbf{Za}_k\| = n$ are necessary to guarantee that the multiple axial constraints are all satisfied. Without this explicit length constraint a solution can be found that satisfies only p axial constraints with nonzero $\mathbf{a}_k$, and the remaining $m–p$ axial constraints being satisfied by choosing $\mathbf{a}_k = \mathbf{0}$. The inequality constraints defined by each C_k are constraints similar to (1) that typically correspond to a nominal or ordinal measurement level and the primary approach to ties (Gifi 1990; Kruskal 1964; Young 1981). Note that $\mathbf{ZA'}$ is identified up to simultaneous linear transformations of both $\mathbf{Z}$ and $\mathbf{A}$, that is, the combination $\mathbf{Z}$ and $\mathbf{A}$ is equivalent to the combination $\mathbf{ZL}$ and $\mathbf{A(LL')}^{-1}\mathbf{L}$ for any nonsingular $p\times p$-matrix $\mathbf{L}$. Therefore, without loss of generality, we impose $\mathbf{Z'Z} = n\mathbf{I}$ and $\mathbf{a}_k'\mathbf{a}_k = 1$. Thus, minimizing $\varphi(\mathbf{X},\mathbf{X}^*)$ over the regional restrictions is equivalent to minimizing

$$\varphi_1(\mathbf{Z},\mathbf{A},\mathbf{C}) = \| \overline{\mathbf{X}} - \mathbf{ZA'C}\|^2_{\mathbf{V}}$$

over $\mathbf{Z}$, $\mathbf{A}$, and $\mathbf{C}$, subject to the constraints $\mathbf{Za}_k \in C_k$ and $\| \mathbf{Za}_k \|^2 = n$.

To minimize function $\varphi_1(\mathbf{Z},\mathbf{A},\mathbf{C})$ we use alternating least squares: that is, first we update $\mathbf{C}$, keeping $\mathbf{A}$ and $\mathbf{Z}$ fixed, then we update $\mathbf{A}$, keeping $\mathbf{Z}$ and $\mathbf{C}$ fixed, and then we update $\mathbf{Z}$, keeping $\mathbf{A}$ and $\mathbf{C}$ fixed. These three steps are carried out iteratively. Minimizing $\varphi_1(\mathbf{Z},\mathbf{A},\mathbf{C})$

over **C** is a straightforward regression problem, for which $\hat{\mathbf{C}} = (\mathbf{AZ'VZA'})^{+}\mathbf{AZ'V}\overline{\mathbf{X}}$ is an optimal solution, where $(\mathbf{AZ'VZA'})^{+}$ is the Moore-Penrose inverse, since **AZ'VZA'** is not of full rank. The main difficulty lies in minimizing $\varphi_1(\mathbf{Z},\mathbf{A},\mathbf{C})$ over **Z** and **A** for fixed **C** over the constraint sets C_k and $\mathbf{a}_k'\mathbf{Z'Z}\mathbf{a}_k = n$.

While updating **Z** and **A**, we keep **C** fixed. Let the singular value decomposition of **C** be given by **PϕQ'**, so that the Moore-Penrose inverse of **C** is given by $\mathbf{C}^{+} = \mathbf{Q}\boldsymbol{\phi}^{-1}\mathbf{P'}$. $\varphi_1(\mathbf{Z},\mathbf{A},\mathbf{C})$ can then be written as

$$\varphi_1(\mathbf{Z},\mathbf{A},\mathbf{C}) = \| \overline{\mathbf{X}} - \mathbf{ZA'C}\|^2_{\mathbf{V}} = \|\mathbf{C}^{+\prime}\,\overline{\mathbf{X}}\,'\mathbf{V}^{1/2} - \mathbf{AZ'V}^{1/2}\|^2_{\mathbf{CC'}} \tag{4}$$

The metric **CC'** makes it difficult to impose the constraints. Therefore, we use an additional majorization step (e.g. see De Leeuw 1994; Heiser 1995). Let $\mathbf{Y}^{*}$ be the matrix **ZA'** obtained in the previous iteration, satisfying all constraints. We can then derive a function majorizing $\varphi_1(\mathbf{Z},\mathbf{A},\mathbf{C})$ by using the following inequality:

$$\left\|\mathbf{Y}^{*\prime}\mathbf{V}^{1/2} - \mathbf{AZ'V}^{1/2}\right\|^2_{\mathbf{CC'}-\phi_1^2\mathbf{I}} \leq 0$$

which can be written as

$$\|\mathbf{AZ'V}^{1/2}\|^2_{\mathbf{CC'}} \leq \phi_1^2\,\|\mathbf{ZA'}\|^2_{\mathbf{V}} - 2\mathrm{tr}\;\mathbf{AZ'VY}^{*\prime}(\phi_1^2\,\mathbf{I} - \mathbf{CC'}) + \|\,\mathbf{Y}^{*\prime}\mathbf{V}^{1/2}\,\|^2_{\phi_1^2\mathbf{I}-\mathbf{CC'}}, \tag{5}$$

where ϕ_1^2 is the largest eigenvalue of **CC'**, that is, the square of the first diagonal element of **ϕ**. Combining (4) and (5) gives

$$\begin{aligned}\varphi_1(\mathbf{Z},\mathbf{A},\mathbf{C}) \leq \phi_1^2\,\|\mathbf{ZA'}\|^2_{\mathbf{V}} - 2\mathrm{tr}\;\mathbf{AZ'VY}^{*\prime}(\phi_1^2\,\mathbf{I} - \mathbf{CC'}) - 2\;\mathrm{tr}\;\mathbf{AZ'V}\overline{\mathbf{X}}\,\mathbf{C'} + \\ \|\mathbf{Y}^{*\prime}\mathbf{V}^{1/2}\|^2_{\phi_1^2\mathbf{I}-\mathbf{CC'}} + \|\,\overline{\mathbf{X}}\,\|^2_{\mathbf{V}}.\end{aligned} \tag{6}$$

To simplify notation, let c_2 denote the last two constant terms in (6), and let **M** denote $\mathbf{Y}^{*}(\mathbf{I} - \phi_1^{-2}\mathbf{CC}) + \phi_1^{-2}\,\overline{\mathbf{X}}\,\mathbf{C'}$. Then (6) can be written as

$$\varphi_1(\mathbf{Z},\mathbf{A},\mathbf{C}) \leq \phi_1^2 \, \|\mathbf{Z}\mathbf{A}' - \mathbf{M}\|^2_{\mathbf{V}} - \phi_1^2 \, \|\mathbf{M}\|^2_{\mathbf{V}} + c_2. \tag{7}$$

The right hand side of (7) is a quadratic function in $\mathbf{ZA}'$. In the case in which all w_{ij}'s are equal to each other, as is typical in MDS of dissimilarities, $\mathbf{V}$ can be written as $n\mathbf{J}'\mathbf{J}$, with $\mathbf{J}$ (the centering operator) defined as $\mathbf{I} - n^{-1}\mathbf{1}\mathbf{1}'$, $\mathbf{I}$ the $n \times n$ identity matrix, and $\mathbf{1}$ the n-vector with all elements equal to one. Therefore, the first term of the right hand side of (7) can, provided that $\mathbf{Z}$ and $\mathbf{M}$ have zero column means which can be imposed without loss of generality, be written as $n\,\phi_1^2 \|\mathbf{Z}\mathbf{A}' - \mathbf{M}\|^2$, which simplifies the majorizing function even further.

For a description of the updates of matrices $\mathbf{A}$ and $\mathbf{Z}$, the reader is referred to the appendix. There are several convergence criteria to be specified for the different loops in the algorithm. First of all, convergence criteria have to be specified for the outer iterations where a constrained configuration with a better Stress value is obtained. Second, a convergence criterion has to chosen for the iterations that minimize $n\,\phi_1^2 \|\mathbf{Z}\mathbf{A}' - \mathbf{M}\|^2$ over $\mathbf{Z}$ and $\mathbf{A}$. Finally, a convergence criterion has to be chosen for the iterations of Dijkstra's cyclic projection algorithm that is used for obtaining the updates of $\mathbf{A}$ and $\mathbf{Z}$ described in the appendix.

Regionally constrained MDS for Levy's political protest acts

Levy (1983) studied the attitudes of respondents from different countries towards different protest behaviors. The items Levy considered varied on three facets: (1) the modality of the attitude (evaluation, approval or likelihood of own overt action), (2) the strength of execution (demanding, obstructive or physically damaging), and (3) the way to carry out the protest (omission or commission) and were constructed as follows. First, 10 protest acts were formulated based on combinations of the levels of facets 2 and 3. These 10 protest acts were then combined with all levels of facet 1. This procedure yields the 30 items in Table 3. These items were rated by respondents on a Likert scale ranging from very positive to very negative. The data that we have available are correlation matrices of the items gathered in five countries (1973-1974): Great Britain (n = 1482), Austria (n = 1584), West Germany (n = 2307), The Netherlands (n = 1201), and the United States (n = 1719).

Borg & Groenen (1997, 2005) analyzed these data by ordinal MDS followed by eyeing to trace back the facet structure. Here, we apply metric MACP MDS with nominal facets. Table 4 shows the unconstrained and the MAPC Stress values. For all five countries, there is some extra Stress due to the multiple axial constraints, but not too much. Therefore, we conclude that imposing the regional constraints still fits the data well.

The MAPC solutions for the countries are given in Figures 4 to 6. The maps for Great Britain, the Netherlands, and the United States are pretty much the same in the sense that the levels for Modality and Strength appear in the same order in the MDS solutions. Therefore, only the map for the Netherlands is shown here. It can be seen that items at the Doing level of the Modality facet correlate more with items at the Approve level than with items at the Effective level. Furthermore, items at the Physically damaging level of the Strength facet correlate higher with those at the Demanding level than with those at the Destructive level. It can also be seen that correlations between some protest acts follow more or less the same pattern at different levels of Modality. For instance, Damage and Violence are more correlated with each other than with Slogans on walls, regardless of the level of Modality. For other groups of protest acts, like Block traffic, Lawful demonstrations, and Petitions, this does not hold. It can be seen that the Carrying out facet only makes a further distinction among the protest acts at the Destructive level of the Strength facet. This is a direct consequence of the facet design in which all protest acts at the Physically damaging and the Demanding levels are acts of commission (logically). On closer look, one can see that the line that separates the Omission from the Commission protest acts is not unique. As a matter of fact, the line can be slightly rotated (counterclockwise) without violating the constraints that are implied by the Carrying out facet.

Table 3 Facet design

Item		Facet A: Modality	Facet B: Strength	Facet C: Carrying Out
1.	Petitions	1 Approve	1 Demanding	2 Commission
2.	Boycotts	1 Approve	2 Obstructive	1 Omission
3.	Lawful demonstrations	1 Approve	1 Demanding	2 Commission
4.	Refusing rent	1 Approve	2 Obstructive	1 Omission
5.	Wildcat strikes	1 Approve	2 Obstructive	1 Omission
6.	Slogans on walls	1 Approve	3 Physically damaging	2 Commission
7.	Occ. buildings	1 Approve	2 Obstructive	2 Commission
8.	Block traffic	1 Approve	2 Obstructive	2 Commission
9.	Damage	1 Approve	3 Physically damaging	2 Commission
10.	Violence	1 Approve	3 Physically damaging	2 Commission
11.	Petitions	2 Effective	1 Demanding	2 Commission
12.	Boycotts	2 Effective	2 Obstructive	1 Omission
13.	Lawful demonstrations	2 Effective	1 Demanding	2 Commission
14.	Refusing rent	2 Effective	2 Obstructive	1 Omission
15.	Wildcat strikes	2 Effective	2 Obstructive	1 Omission
16.	Slogans on walls	2 Effective	3 Physically damaging	2 Commission
17.	Occ. buildings	2 Effective	2 Obstructive	2 Commission
18.	Block traffic	2 Effective	2 Obstructive	2 Commission
19.	Damage	2 Effective	3 Physically damaging	2 Commission
20.	Violence	2 Effective	3 Physically damaging	2 Commission
21.	Petitions	3 Doing	1 Demanding	2 Commission
22.	Boycotts	3 Doing	2 Obstructive	1 Omission
23.	Lawful demonstrations	3 Doing	1 Demanding	2 Commission
24.	Refusing rent	3 Doing	2 Obstructive	1 Omission
25.	Wildcat strikes	3 Doing	2 Obstructive	1 Omission
26.	Slogans on walls	3 Doing	3 Physically damaging	2 Commission
27.	Occ. buildings	3 Doing	2 Obstructive	2 Commission
28.	Block traffic	3 Doing	2 Obstructive	2 Commission
29.	Damage	3 Doing	3 Physically damaging	2 Commission
30.	Violence	3 Doing	3 Physically damaging	2 Commission

Table 4 Stress values per country of unconstrained metric MDS and regionally constrained MAPC MDS with $p = 2$

Country	Unconstrained Stress	Regionally Constrained Stress
Great Britain	.086	.107
Austria	.084	.107
West Germany	.078	.106
The Netherlands	.087	.104
United States	.076	.107

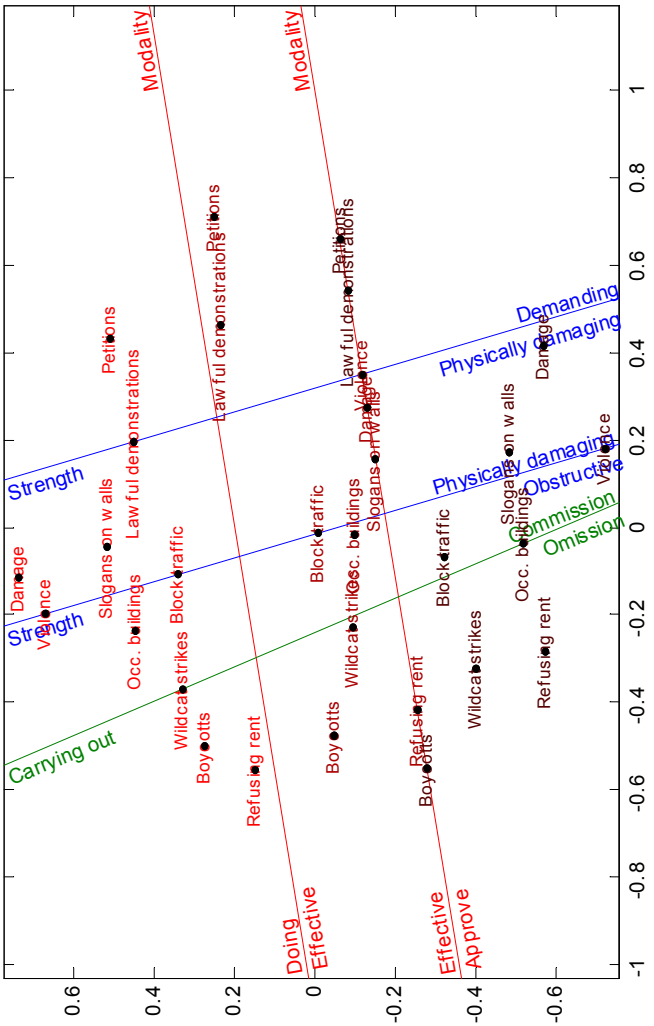


Figure 4 MAPC MDS solution of the Levy data for Austria

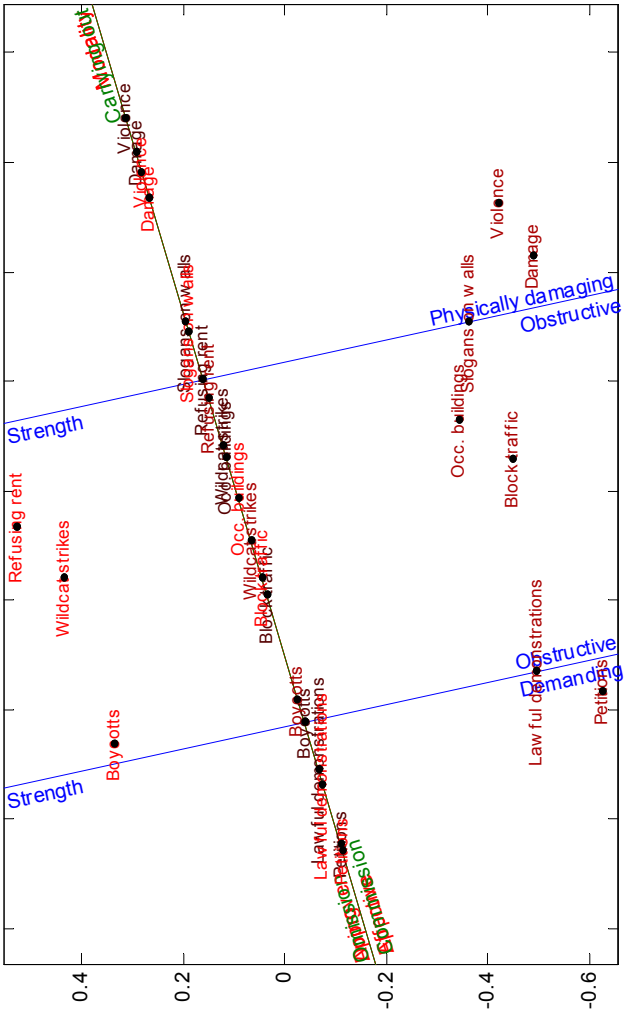


Figure 5 MAPC MDS solution of the Levy data for West Germany

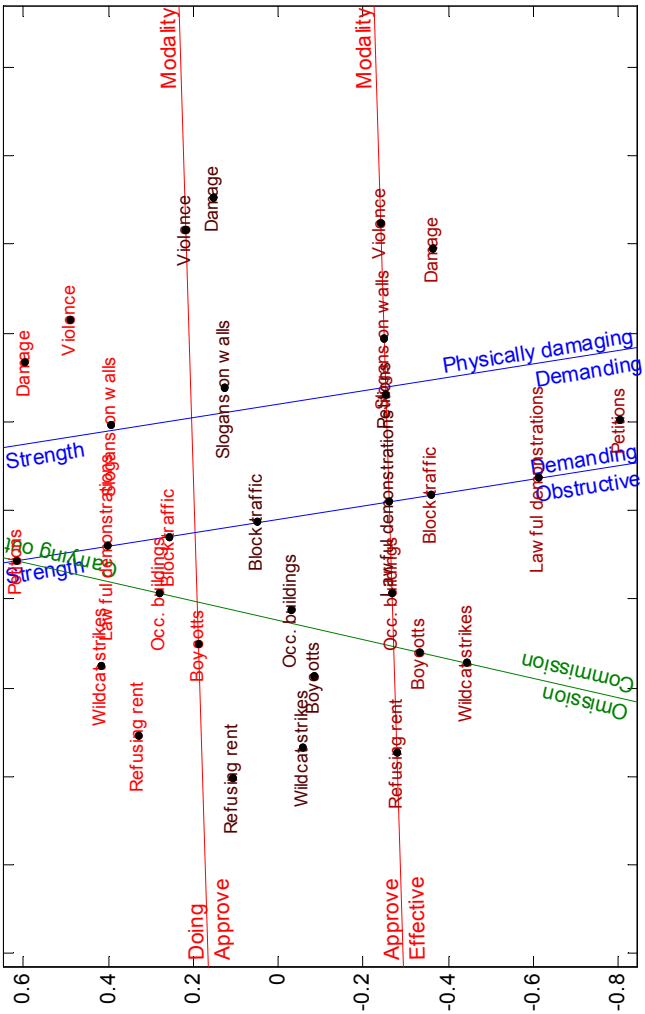


Figure 6 MAPC MDS solution of the Levy data for The Netherlands

In the map for Austria, we see an interchange in the order of the Approve and the Effective levels of the Modality facet, and an interchange in the order of the Physically damaging and Demanding levels of the Strength facet. Despite these interchanges, whose interpretation is outside the scope of this paper, the facet structure is very clear.

West Germany shows how things can go wrong. Although the Stress did not increase too much by imposing multiple axial partitioning constraints, it turns out that in the final MDS solution a large number of the constraints imposed by the Modality and the Carrying out facets are active. As such, many items are located on the boundary of their corresponding slices. In fact, the constraints even lead to a situation in which there are no locations in the map that uniquely correspond to the Doing level of the Modality facet. The whole slice coincides with the boundaries of both the Approve and the Effective level. This leads to such a clutter of items in the map that the map becomes virtually uninterpretable. One might argue that it appears that the facet structure apparently is not so dominant in the data. The fact that the Stress increased only slightly seems to be an indication of the flatness of the Stress function near the (perhaps locally) optimal solution. Unlike the other countries, Germany has the Doing and the Obstructive levels of the corresponding facets as middlemost levels.

Conclusion and Discussion

We proposed the MAPC MDS model that allows for the inclusion of multiple axial regional constraints. In MAPC MDS it is possible to specify more constraining facets than dimensions. The facets are incorporated in the MDS map in such a way that each individual level can readily be identified, and there is a unique one-to-one mapping between locations in the map and levels of each of the facets.

The proposed algorithm for MAPC MDS is very flexible in the sense that the Stress function that is being minimized incorporates weights that can be used to control the impact of the misfit of the individual dissimilarities on the overall Stress. Amongst others this makes sure that the algorithm can both be used for MDS of dissimilarities and for the unfolding of preferences. The latter may have strong applications in the area of marketing and new product development.

It must be recognized that the expand-and-shrink operation, rewriting **X** as **ZA'C**, does not completely cover all possible solutions that satisfy the multiple axial-wise partitioning constraints. Actually, it may happen that it is advantageous for the minimization of Stress to confine the constraining directions to a lower-than-p-dimensional subspace of the map. For instance, the advantage of confining the directions to a (p–1)-dimensional subspace will be that the remaining dimension will be completely unrestricted. Actually, our definition of the constraints does not prohibit us to let all directions coincide, to let all items share the same coordinate on that dimension, and to actually fit the dissimilarities in (p–1) unconstrained dimensions! Obviously, such a solution would destroy the whole rationale behind the imposition of multiple axial-wise partitioning constraints. As a matter of fact, the attractiveness (from a Stress minimization point of view) of such uninformative solutions in the illustration shown can be checked by comparing Stress values for unconstrained and MAPC MDS for different dimensionalities.

A two-dimensional perceptual map gives a nice trade-off between an optimal representation of the data and parsimony of the map. The choice of two dimensions made it simple to visualize the level-separating hyperplanes, which are lines in this case, and inspect the MDS maps. Visualization of the level-separating hyperplanes and visual inspection of the maps become much more difficult in higher dimensionality. So, one line of further research could investigate ways in which more-than-two-dimensional perceptual maps with multiple axial partitioning constraints can best be visualized (cf. Buja & Swayne 2002). Preferably one would carry out some empirical studies to see which ways of visualization are most easy to use and most appreciated by the people that will have to deal with the results of MAPC MDS in practice. Of course, results may amongst others depend on the particular type of product and the kind of constraining characteristics involved.

A disadvantage of our multiple axial constraints, dividing the MDS map into slices, is that not every possible level combination of the constraining attributes can be represented by a separate region. Two facets with two levels each yield a region for every combination of levels in two dimensions. However, three facets of two levels each give three separation lines yielding at most seven regions out of eight possible combinations of levels. As the number of facets increase with respect to the number of dimensions, or the number of levels per facet increase, there will be a larger proportion of level combinations that can not be

represented by separate regions. As a consequence, more and more level combinations will coincide at level-separation lines and more and more items will be located on these boundaries, making the interpretation increasingly more difficult and the map less useful. Therefore, another line of research may aim at the specification of a different type of constraints that divide the map into mutually exclusive regions in such a way that all (or almost all) level combinations can be represented by a separate region. To keep the interpretation of the map easy, each category combination should preferably correspond to one region and not to two or more disconnected regions. Borrowing ideas from facet theory again, one could think amongst others of radial and polar constraints (e.g. see Borg & Groenen 1997, Chapter 4).

In addition, varieties of MAPC for three-way MDS, such as the weighted Euclidean model (also used in INDSCAL) could be developed. The multiple axial constraints can also be readily implemented in other techniques, like PCA, generalized canonical correlation analysis, correspondence analysis, etc.

We need some procedure that exactly determines whether we have one unique hyperplane or an infinite number of hyperplanes within some 'hyper region', separating the subsequent regions that correspond to the levels of a particular facet. To create unique hyperplanes, an extra penalty term could be used much in the same way as in support-vector machines.

Appendix

*Updating **A***

There are several ways to update **A**. First, we can bring the problem back to a standard nonnegative least squares problem. Minimizing (7) over **A** is equivalent to minimizing

$$\tau(\mathbf{a}_k) = \|\mathbf{Z}\mathbf{a}_k - \mathbf{m}_k\|^2, \tag{A1}$$

for each row, $\mathbf{a}_k$, of **A**. For orthonormal **Z**, the normalization constraints $\|\mathbf{a}_k\|^2 = 1$ and $\|\mathbf{Z}\mathbf{a}_k\|^2 = n$ are equivalent. Because nominal and ordinal partitioning characteristics define cones, $\tau(\mathbf{a}_k)$ may be minimized without the length constraint followed by proper normalization (De Leeuw 1977; Gifi 1990).

The minization of (A1) can be transformed into a nonnegative least-squares problem as follows. The ordinal partioning constraints are given by $\mathbf{t}_k = \mathbf{S}_k\mathbf{Z}\mathbf{a}_k \geq \mathbf{0}$, so that $\mathbf{S}_k^{-1}\mathbf{t}_k = \mathbf{Z}\mathbf{a}_k$. Thus, minimizing $\tau(\mathbf{a}_k)$ is equivalent to minimizing

$$\| \mathbf{S}_k^{-1}\mathbf{t}_k - \mathbf{m}_k \|^2 \text{ subject to } \mathbf{t}_k \geq \mathbf{0}, \tag{A2}$$

a standard nonnegative least squares problem that can be solved by the analytic method of Lawson & Hanson (1974) or the iterative merthod of Groenen, Van Os & Meulman (2000).

An alternative approach to updating **A** is by using Dykstra's (1983) cyclic projection algorithm. By iterative projections onto the hyperplane defined by **Z** and onto the cones C_k, and subsequent proper normalization one obtains the normalized projection, say, $\hat{\mathbf{M}}$, of **M** onto the intersection of the hyperplane and the cones. The update for **A** is then obtained as $n^{-1}\hat{\mathbf{M}}'\mathbf{Z}$, as **Z** is orthonormal. For the projections onto the hyperplane defined by **Z**, no increment has to be subtracted before projections (see Gaffke & Mathar 1989; von Neumann 1950). The advantage of using the cyclic projection algorithm lies in the fact that projections onto the cones C_k can be carried out very efficiently by Kruskal's (1964) up-and-down blocks algorithm, whereas on the other hand the $\mathbf{S}_k$'s in (A2) will tend to have a large number of rows due to the primary approach to ties. A disadvantage of the cyclic projection algorithm as compared to the analytic method of Lawson & Hanson (1974) is that it is iterative.

Updating ***Z***

To update **Z** we first drop the orthonormality constraints on **Z**, and impose them again afterwards. This procedure works fine, as long as the update without orthonormality constraints is of full rank. We do not expect **Z** to be of reduced rank, because that would be contradictory to minimization of the loss unless the dissimilarities can indeed be fitted in a p-dimensional space with $p < m$.

There are again two ways to find an update. First, the problem can be transformed into a standard nonnegative least squares problem. Let $\mathbf{z} = \text{vec}(\mathbf{Z})$ denote the vector of all columns of **Z** stacked under each other, and $\mathbf{m} = \text{vec}(\mathbf{M})$ denote the vector of all columns of **Z** stacked under each other. Also, let **S** denote the partitioned block matrix with blocks equal to $a_{kt}\mathbf{S}_k$, and **G** a partitioned block matrix with blocks $a_{kt}\mathbf{I}$, with **I** the $n \times n$ identity matrix. Then, minimization of $\|\mathbf{ZA}' - \mathbf{M}\|^2$ over **Z** subject to $\mathbf{S}_k\mathbf{Z}\mathbf{a}_k \geq \mathbf{0}$ can be written as

$$\|\mathbf{Gz} - \mathbf{m}\|2 \text{ subject to } \mathbf{Sz} \geq 0.$$

Substituting $\mathbf{t} = \mathbf{Sz}$ gives the standard nonnegative least-square problem of minimizing

$$\|\mathbf{GS}^{-1}\text{t} - \mathbf{m}\|2 \text{ subject to t} \geq 0.$$

Alternatively Dykstra's (1983) cyclic projection algorithm can be used again. This time, **M** is projected onto the intersection of the hyperplane defined by **A** and the cones C_k.

Assuming that the solution $\hat{\mathbf{M}}$ is of full rank with singular value decomposition $\mathbf{K}\Lambda\tilde{\mathbf{L}}'$ Then choosing

$$\hat{\mathbf{Z}} = n^{1/2}\text{K}$$
$$\hat{\mathbf{A}} = \tilde{\mathbf{A}}\text{L, and}$$
$$\hat{\mathbf{C}} = n^{-1/2}(\tilde{\mathbf{A}}')^{-1}\text{LK}'\hat{\mathbf{M}}\,\tilde{\mathbf{A}}'\tilde{\mathbf{C}}$$

yields an orthonormal update for **Z**, while keeping $\|\mathbf{a}_k\|^2 = 1$. Here, $\hat{\mathbf{Z}}$, $\hat{\mathbf{A}}$, and $\hat{\mathbf{C}}$ are the updates for matrices **Z**, **A**, and **C**, and $\widetilde{\mathbf{A}}$ and $\widetilde{\mathbf{C}}$ are the matrices **A** and **C** that were kept fixed while updating **Z**.

For nominal axial-wise partitioning constraints we have to check all $\frac{1}{2}\times\Pi_{k=1}^{m} J_k$ combinations of orders along the partition axes, where J_k is the number of levels for facet k. If the J_k or K gets larger, the number of combinations to be checked explodes, so that the algorithm becomes slow. When Dykstra's algorithm is used, a branch and bound strategy can be applied to speed up computations. This branch and bound strategy is based on the fact that, for instance when updating **A**, Dykstra's algorithm yields a series of vectors that are: *i*) successively getting closer to the projection of $\mathbf{m}_k$ onto the intersection of the closed convex cones C_k and the space spanned by **Z**, and *ii*) decreasing in length, whereas this length is a direct measure of the Euclidean norm of the difference between the vector and $\mathbf{m}_k$. So, for any permutation the iterations of Dykstra's algorithm can be stopped, as soon as the length of the vector becomes smaller than the length of the projection obtained for some other permutation. As the overall program approaches convergence it becomes ever more likely that the 'best' permutation from the previous iteration updating **A** will also be the 'best' permutation in the current iteration. Therefore, it is efficient to start with the 'best' permutation from the previous iteration, so that the change of being able to stop Dykstra's algorithm for all other permutations after a relatively small number of iterations is relatively high. While updating **A**, we can apply the branch and bound strategy for the orders from each characteristic, so for each row of **A**, separately. While updating **Z**, we have to apply the strategy for all combinations of orders simultaneously.

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A COMPARISON BETWEEN FACTOR ANALYSIS AND SMALLEST SPACE ANALYSIS OF THE COMPREHENSIVE SCORING SYSTEM OF THE RORSCHACH

ARIE COHEN

Abstract: *The purpose of the present study is to compare the solution of a previously published Rorschach factor analytic study to an SSA solution of the same data. This analysis yielded a radex structure with a modulating facet ranging from number of responses and location scores at the origin to determinants and response quality at the periphery. The polarizing facet divided the map into sectors representing response determinants – color variations vs. form variations. This solution supports Rorschach's original scoring system but suggests that the distinctions between different types of movements (human vs. animal), colors (chromatic, achromatic, and shading) and the distinction between them and their primary form counterparts have been exaggerated.*

The scientific status of the Rorschach test is one of the most controversial issues among clinical psychologists and psychometricians alike. It is the most revered and most reviled psychometric instrument. Thus, while Exner (1993) points to the Rorschach inter-rater reliability and Hiller, Rosenthal, Bornstein, Berry & Brunell-Neuleib (1999) have demonstrated its respectable validity, Lilienfeld, Wood & Garb (2000) consider it a problematic instrument from a psychometric standpoint.

One common approach to obtain insight into the underlying structure of a psychometric instrument and to support its theoretical assumptions is through factor analysis. Indeed, several studies have been executed in order to bridge the gap between theory and research concerning the modern scoring system of the Rorschach (Anderson & Dixon 1993; Costello 1998; Meyer 1989, 1992). Nevertheless, the findings of these studies were quite disappointing. Meyer, who had reviewed several factor-analytic studies of the Rorschach and conducted some of these studies himself, concluded that although the Rorschach

exhibited a relatively consistent factor structure, its "internal structure does not clearly correspond to that which would be expected from traditional variable interpretation" (Meyer 1992: 132).

In view of the lack of support of factor-analytic studies for a clear theoretical underlying structure of the Rorschach, the use of non-metric alternatives to factor analysis should be considered. Furthermore, these alternatives may be less sensitive than factor analysis to issues that characterize the Rorschach scores such as collinearity, interdependence, variables with skewed distribution, very low or very high base rates, and very small variances.

One of these nonmetric alternatives to factor analysis relates to the multidimensional scaling (MDS) approach (Guttman 1966, 1968; Kruskal 1964). The above methodologies represent variables as points in an Euclidian space with interpoint distances corresponding to proximity measures among the variables (e.g. intercorrelations). The underlying assumption of this approach is that the isomorphism between the proximity measures and their interpoint distances in a Euclidian space enables direct observation in an intercorrelation matrix which may highlight data structures that are not so apparent in factor-analytic solutions.

In view of the potential of this approach in revealing aspects of the data that may be obscured by traditional factor-analytic techniques, the purpose of the present study is to reanalyze the intercorrelation matrix of a previously published Rorschach score. The data that were selected for this analysis are those of Zillmer & Vuz (1995). These data were selected because of the authors' careful selection of the variables that are appropriate for factor analysis and their meticulous approach in handling all the technical aspects of performing factor analysis, as well as their detailed report of their finding. Zillmer's & Vuz' (1995) data were based on Rorschach protocols of 160 psychiatric inpatients. They have identified among 17 comprehensive system scores four factors: (a) Holistic Response (Zf, W, M), (b) Perceptual Accuracy (X+%, X-%, P, F+%), (c) Non-Form-Dominant (CF+C, C'F+C', ShadeF, M), and (d) Form dominant (FC, Fshd, S, R, FC', FD). Zillmer & Vuz admit that their four-factor solution does not offer a complete model of the Rorschach scoring system but conclude nevertheless that it indicates that the current scoring system provides distinct domains of personality. Thus, it is of interest to examine whether the MDS approach leads to the same conclusion.

Results and Discussion

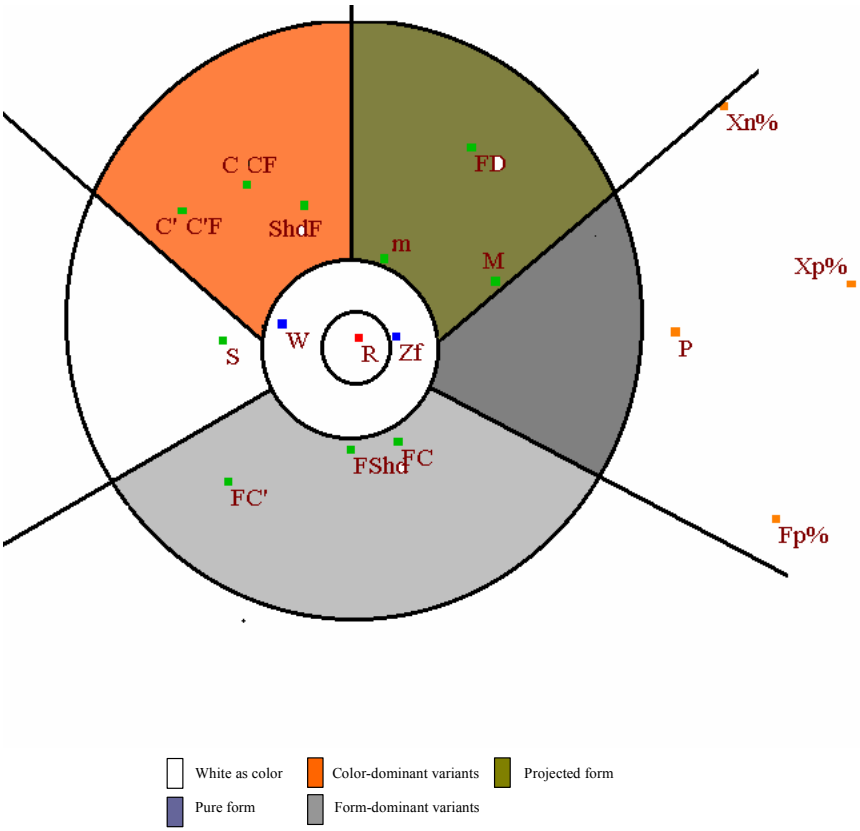
Zillmer's and Vuz' (1995) original intercorrelation matrix was reanalyzed by Smallest Space Analysis (SSA; Amar & Toledano 2001) and yielded a two-dimensional solution (see Figure 1) with a coefficient of alienation of .176. This coefficient is the loss function of SSA and it measures the goodness of fit between the obtained solution and the original data. It ranges from 1 to 0 (the later represents a perfect match). A value of .2 or less indicates a good fit (for further discussion of mathematical aspects of SSA, see Borg & Shye 1995).

At the center of Figure 1 appears the total number of response (represented by the letter R) a variable that correlates with all Rorschach measures. The second circle in Figure 1 contains two holistic measures that indicate an integrative ability, an ability to perceive the card as a whole (W) or to integrate different parts of the cards into a holistic percept (Zf). Five sectors, which contain response determinants, divide the next circle. The left sector in the third circle contains space response (S), namely, a white-color response.

The next sector moving clockwise contains color (C) and color-variations responses, such as shading and achromatic-color determinants (C, CF, ShdF, C', C'F). The next sector contains three figure dominant 'projective' scores, i.e., responses that incorporate form and additional characteristic such as movement (M – human movement, m – inanimate movement) or dimensionality, like depth or distance (FD). The next sector is empty but from the overall structure of Figure 1, we may infer that it should have included pure-form responses (F). The last sector represents variations of form responses such as form with color (FC), achromatic color (FC') or shading (FShd). The next circle has only one sector (adjacent to the empty sector which is assumed to represent pure form responses), which represents perceptual accuracy including responses of pure good form (F+%); popular (P) or conventional responses (X+%); or lack of perceptual distortion (X-%).

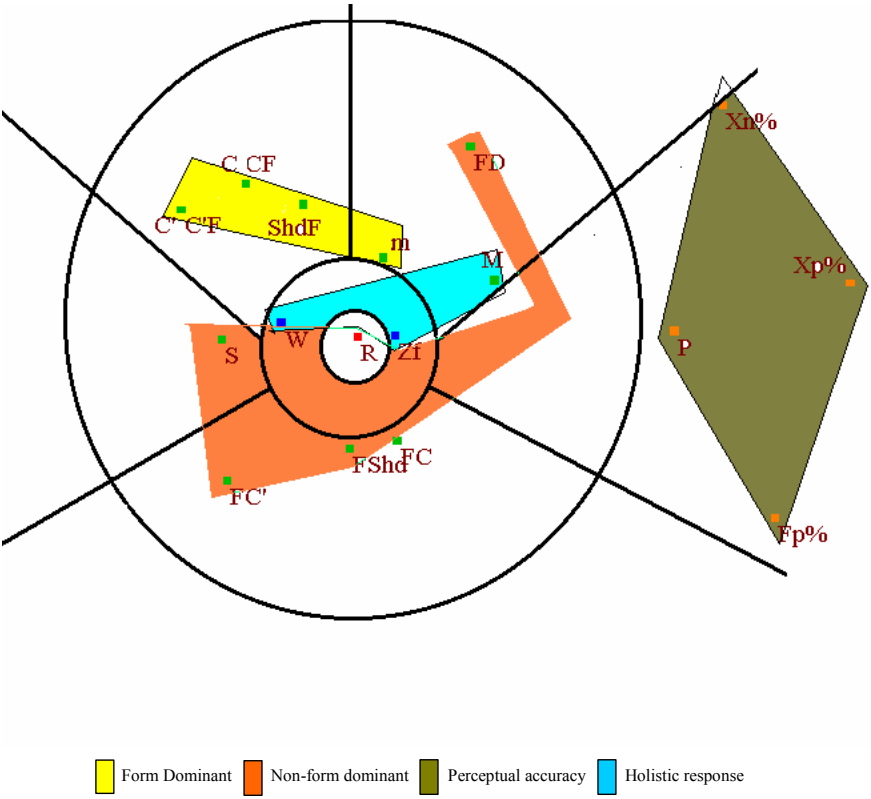
The present SSA solution represents a radex structure (Guttman 1954). The modulating facet ranges from general productivity measure (number of responses) at the origin of the figure, 'holistic and organizational' measures next, then scores of response determinants and finally 'accuracy' measures at the periphery. The polarizing facet relates mainly to the response-determinant section and includes its main characteristics. One sector represents variations of form responses while the opposite sector represents variants of color responses. Between these two polarities appears a sector with variants of form response with additional characteristics (movement or depth – 'projective forms') and a sector with form responses that includes a white space.

Figure 1 Smallest space analysis of Rorschach data from Zillmer & Vuz (1995)



The present SSA solution is not much different from Zillmer's & Vuz' (1995) original solution. Figure 2 contains Zillmer's & Vuz' factor solution superimposed on the SSA solution. The Perceptual Accuracy factor of Zillmer & Vuz matches the same region in the present solution. Their Non-Form-Dominant and Holistic Response factors are very similar to the 'color variations' region and the Holistic Measures region in the SSA solution, respectively.

Figure 2 Factor analysis solution of Rorschach data from Zillmer & Vuz (1995) superimposed on the SSA solution



Nevertheless, in spite of the similarity between the factor-analytic solution and the SSA solution, the SSA solution is more elegant, it is without any deviations, and it presents a holistic view of the interrelations among the regions ('factors'). Furthermore, the present interpretation of the underlying structure of the Rorschach is based solely on the perceptual characteristics of the response rather than on any personality characteristics.

In general, the present study suggests that the Rorschach responses can be categorized into four main determinant categories: form-only, form-dominant, color-dominant, and white-space responses. Furthermore, from the present study its seems that the distinctions among the variations of color responses (chromatic, achromatic, and shading), among primary-form responses (combinations of form responses with colors, chromatic colors, and shading), and among movement responses (human vs. animal) are somewhat artificial (cf. Meyer 1989).

Finally, the findings of the present study support the basic concepts in Rorschach scoring systems – productivity, location, determinants, and form quality – but not necessary its clinical implications. Nevertheless, these findings are based on one sample of hospitalized patients and the Rorschach scores are not controlled for the number of responses, a factor that may skew the findings.

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ON THE STRUCTURE OF MOTIVES: BEYOND THE 'BIG THREE'[1]

WOLFGANG BILSKY

***Abstract**: Stressing common features of motives and values, an attempt is made to outline a general and parsimonious taxonomy for classifying motives by borrowing from Schwartz' (1992) value theory. This is achieved by applying two basic dimensions found in value research to the structural analysis of motives. The tenability of this approach is tested by analyzing multitrait-multimethod matrices of different motivational indicators by means of multidimensional scaling. Results support the hypothesized distinction and structure of stable motivational domains.*

Distinguishing features of values and motives

Almost two decades ago, Heckhausen (1989) stated that there has not been a satisfying solution for classifying motives in the past. Scanning more recent literature shows that his critique still holds today. A closer look at the labels used for distinguishing among motives reveals, however, a considerable overlap with labels used in value research (see Rokeach 1973; Schwartz 1992). Because of the striking similarities in naming variables it seems implausible to attribute this overlap to mere chance. Instead, these similarities suggest some systematic correspondence between the respective constructs which needs further empirical and conceptual clarification. In this paper, an attempt is made to outline a general and parsimonious taxonomy for classifying motives. This is accomplished by borrowing from the theory on the structure of values as developed and continuously refined by Schwartz (Schwartz 1992; Schwartz & Bilsky 1987, 1990; Schwartz & Sagiv 1995). The tenability of this proposal is investigated by (re-)analyzing several multitrait-multimethod (MTMM) matrices of motive and value indicators.

1 I am grateful to David Cairns, Kurt Sokolowski and Dirk Wentura for their comments on an earlier draft of this paper.

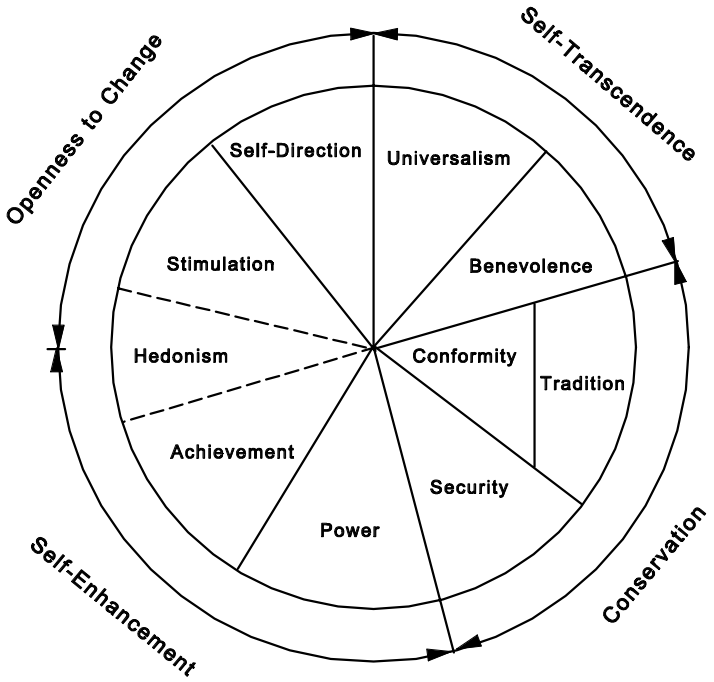
Values

In their early research on the universal content and structure of values, Schwartz and Bilsky (1987) defined values as concepts of trans-situational goals that express individualistic or collectivistic interests and are characterized by a particular motivational content. Within this definitional context, *motivational content* was considered a central and distinguishing feature. Grouping values into classes according to their motivational content results in value types, which differ from each other with respect to mutual compatibilities and incompatibilities. These (in-)compatibilities give rise to stable value structures which could be identified by Multidimensional Scaling (MDS) analysis of data from a variety of cross-cultural samples (Schwartz & Bilsky 1990).

In the following years, Schwartz (1992) revised and considerably extended this early approach. Amongst other things, he identified two essentially orthogonal dimensions which parsimoniously describe value structures. The first, *'openness to change versus conservation'*, arranges values according to the extent to which they motivate individuals to follow their own interests in unpredictable and uncertain directions versus to preserve the status quo and the certainty it provides. The second, *'self-enhancement versus self-transcendence'*, arrays them according to the extent to which they motivate individuals to look after their own interests versus the extent to which they motivate persons to transcend selfish interests and promote the welfare of others (Schwartz 1992: 42-43). Figure 1 illustrates the theoretical structure of relations among the motivational types of values.

Since then, Schwartz has tested and validated his theoretical approach in numerous countries, analyzing a diversity of samples and using different research instruments. On the whole, analyses revealed both stable patterns of value structure and cultural specifics (Schwartz & Sagiv 1995; Schwartz, Melech, Lehmann, Burgess, Harris & Owen 2001).

Figure 1 Schwartz' model of value structure (cf. Bilsky & Schwartz 1994: 168)



Motives

As with values, the definition of motives is based on their distinguishing features. According to Heckhausen (1989), there are as many motives as there are different classes of *'person-environment relations'*. These relations can be further distinguished by characteristic goals aspired to. Following this line of reasoning, we see that motives and values serve *similar functions* to the extent that they direct human behavior. In this respect they both differ from personality traits which are typically seen as mere descriptions of observed patterns of behavior (Bilsky & Schwartz 1994).

Considering the aforementioned similarities of motives and values, it is not surprising to learn that the classification of motives found in the literature closely resembles the classification of values in the Schwartz model (Figure 1). Thus, we find categorizations into achievement and power motives, curiosity, self-actualization, altruism, and anxiety, for instance. The respective values supposed to match these motives would probably be: achievement, power, stimulation, self-direction, benevolence, and security.

However, other than value research, investigations into motives have mostly concentrated on one (e.g. achievement) or a few motives at best (e.g. the 'big three': achievement, power, and affiliation). As a result, there has not been much interest in taxonomic questions. Furthermore, textbooks and reviews offer only more or less comprehensive lists of motives, which do not go beyond *nominal distinctions*. Now, given that the suggested motive-value relationship holds, the *position of a motive relative to* Schwartz' *two basic dimensions* would be revealing in two respects: (1) Its location within a fixed frame of reference facilitates a *parsimonious definition* in terms of basic characteristics. Hereby, some ambiguities of nominal definitions can be avoided which often result from using suggested or actual synonyms, unspecified frames of reference, if any, etc. (2) The relative position within a shared frame of reference suggests hypotheses on the *compatibilities* and *conflicts* with other motives which can easily be tested empirically.

Structural expectations

There has been considerable debate in the past about the fact that different indicators of the supposedly same type of motive often failed to result in substantial correlations. This debate is closely linked to the distinction of implicit and explicit measures in motivational research (McClelland, Koestner & Weinberger 1989). While this distinction is not the focus of the present paper, it should be stressed, that in general moderate or low correlations between different types of indicators (e.g. between a projective measure and a questionnaire) supposed to assess the same motive (e.g. achievement) do not necessarily contradict a common overall structure of motives. We should expect, indeed, that – within each type and across different types of indicators – the *correlational pattern* of measures for different motives is the same. More precisely, motives are hypothesized to relate to each other according to their compatibilities and incompatibilities in the same way as values. Consequently, the *two basic dimensions* of the Schwartz model (1992) should be suitable for describing motivational structure. The rationale of this assumption is that structure arises from the *simultaneous* inspection of *all correlations* between motivational indicators. It is the *overall pattern* of contingencies and not the single bivariate correlation which is important for the identification of structural relationships.

The validity of this assumption can be tested by analyzing proximities (correlations) of motivational indicators in multidimensional space. These proximities depict interrelations between all indicators at a time as summarized in a multitrait-multimethod (MTMM) matrix (Borg 1998, 1999; Borg & Groenen 1997). As the taxonomy of motives proposed in this paper directly relates to the Schwartz (1992) value model, hypothesis testing is accomplished in the same way as in his cross-cultural value research, i.e., by nonmetric MDS (Borg & Groenen 2005). Thus, the present findings can be directly compared to Schwartz' value studies.

Following Schwartz' (1992) reasoning and provided that a broad range of motives has been assessed, *four wedgelike regions* are hypothesized to emerge in an MDS of motivational indicators, one for each pole of the two basic dimensions as shown in Figure 1. In other words, motives that are similar with respect to these dimensions are expected to form one coherent spatial region. In contrast, motives that differ with respect to both dimensions should spread apart on the same projection of similarities (for further information on testing regional hypotheses through MDS, see Borg & Shye 1995; Levy 1985).

Jackson's (1974) Personality Research Form (PRF) is one of the few inventories which go beyond the 'big three', covering a wide range of motivational constructs. Therefore, data collected with this instrument are especially suited for testing our assumptions. In the following we present the reanalysis of data provided by Stumpf et al. (1985) in their manual of the German Personality Research Form. These authors discussed the convergent and discriminant validity of the German PRF in considerable detail. In this context, they reported two MTMM-matrices, each of them containing intercorrelations of 14 PRF-scores, self- and peer-ratings, respectively.

The German Personality Research Form: Inherent basic dimensions

A priori to applying MDS to these MTMM-matrices, the 14 PRF-motives (achievement, affiliation, etc.) and the 10 value types of the Schwartz model were matched according to their verbal descriptors. This task was accomplished independently by Shalom H. Schwartz[2] and by the author. The joint results of our attempt are summarized in Table 1. As can be seen, no clear counterparts of 'social recognition' and 'succorance' could be identified within values. However, more important than matching motives and value types is the assignment of motives to the *basic (value) dimensions* (third column) which are intended to serve as a taxonomic frame of reference. This assignment specifies the *regional hypotheses* to be tested by means of MDS.

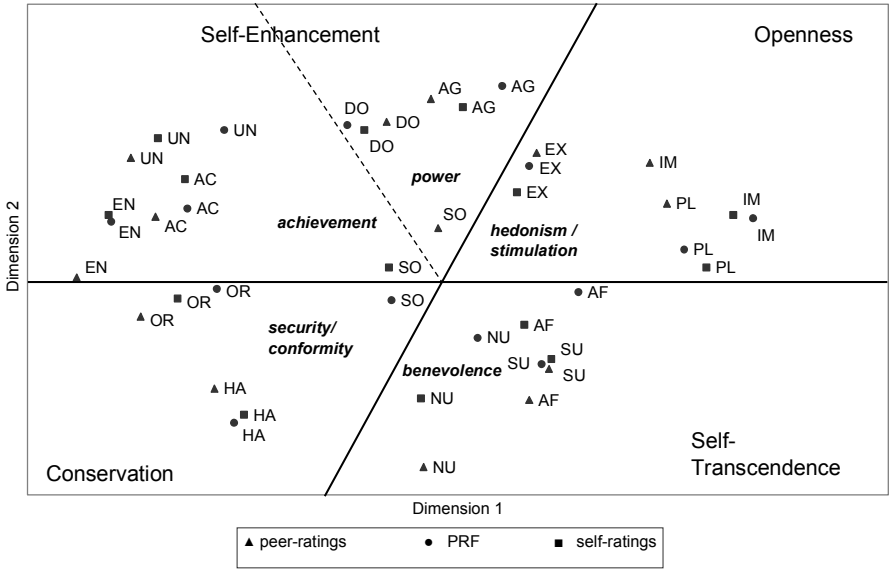
2 Personal communication, January 16, 1998.

Table 1 A priori matching of motives (PRF), value types, and basic value dimensions according to the verbal descriptors of the respective constructs

motive	value type	value dimension
achievement: AC	achievement, power	self-enhancement
affiliation: AF	benevolence	self-transcendence
aggression: AG	power; benevolence(-), conformity (-)	self-enhancement
dominance: DO	power	self-enhancement
endurance: EN	achievement	self-enhancement
exhibition: EX	stimulation; tradition (-)	openness to change
harmavoidance: HA	security, tradition; stimulation (-)	conservation
impulsivity: IM	stimulation; conformity, tradition (-)	openness to change
nurturance: NU	benevolence; power (-)	self-transcendence
order: OR	security; stimulation (-)	conservation
play: PL	hedonism, stimulation	openness to change
social recognition: SO	(?) conformity, achievement	(?) conservation, self-enhancement
succorance: SU	(?) security	(?) conservation
understanding: UN	self-direction; tradition (-)	openness to change

The first multitrait-multimethod matrix of PRF-scores, self- and peer-ratings is based on a sample of $N = 215$ (Stumpf et al. 1985: 55). Analyses were run by means of the *SYSTAT* program package (version 11.0). A two-dimensional nonmetric MDS of the 3 x 14 indicators yielded a coefficient of alienation $K = .21$ (Borg & Groenen 2005). Figure 2 shows the two-dimensional projection of all 42 variables and their wedgelike separation according to the regional hypotheses.

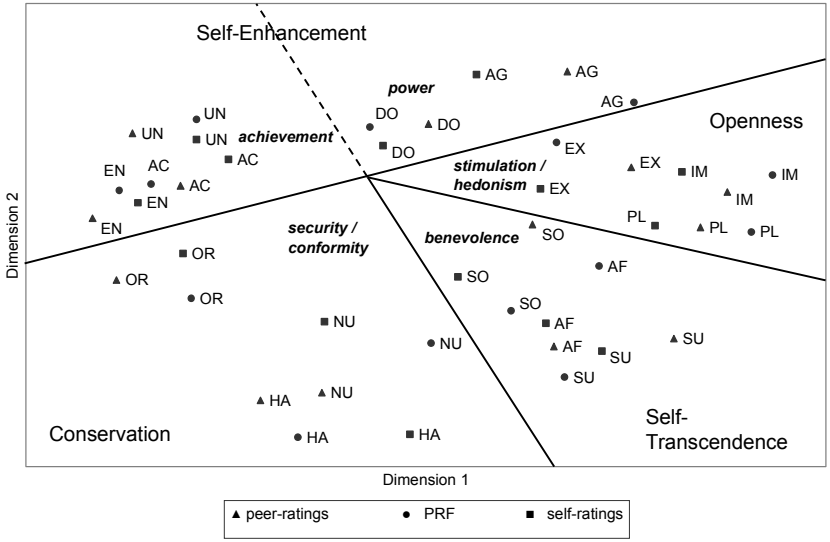
Figure 2 Two-dimensional nonmetric MDS of 14 motives (PRF; cf. Stumpf et al. 1985: 55)



As can be seen, five complex motivational regions emerged. Their positions fit quite well the configuration predicted from the basic dimensions. Thus, achievement and power (i.e., self-enhancement) are opposed to benevolence (self-transcendence). Furthermore, hedonism/stimulation (openness to change) is located opposite to security/conformity (conservation), as expected. Only 'understanding', which was expected to be an indicator of 'openness to change', resulted as a misfit.

The second MTMM-matrix (N = 169) from the Stumpf et al. study (1985: 59) was analyzed correspondingly. The two-dimensional MDS (K = .21) of this dataset revealed essentially the same partitioning of motives as the first analysis. The resulting structure is presented in Figure 3. Here again, 'understanding' is located in the achievement sector, suggesting that its structural association has to be reconsidered if this placement should be replicated in further analyses.

Figure 3 Two-dimensional nonemtric MDS of 14 motives (PRF; cf. Stumpf et al. 1985: 59)



The two motives which remained unclassified in our a priori classification of PRF-variables behaved differently in the present analyses. While we conjectured a vague association between 'succorance' and security (conservation), this motive was clearly associated with benevolence (self-transcendence) in both samples. 'Social recognition' emerged in the middle of the MDS plots, showing no stable association with either dimension. This may be due to the fact that social recognition implies both aspects of achievement (status) and benevolence (social relation). In spite of these unforeseen findings, the results from both studies support the hypothesis that structural interrelations between motives can be represented by the same two basic dimensions consistently found in cross-cultural value research (see Schwartz & Sagiv 1995). One final aspect of these results should be emphasized in this context: Contrary to the often deplored 'unrelatedness' of motivational indicators, all variables supposed to represent the same motive (e.g. dominance) are located in close proximity in this plot, thus confirming our assumption of a common structure of methodologically different indicators.

A joint analysis of values and motives

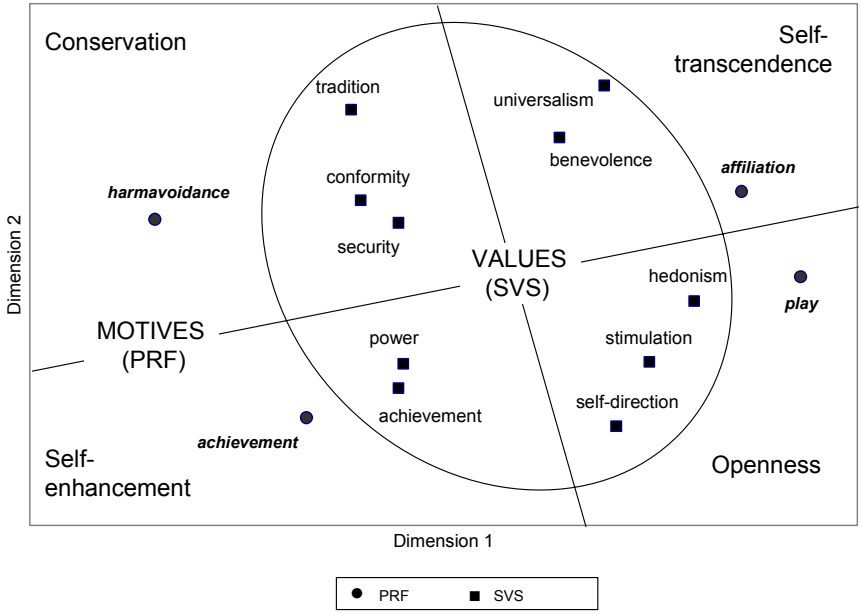
While the above analyses look promising as to the applicability of the Schwartz model to motives, evidence is indirect. The usefulness of this approach would appear still more convincing if a *joint analysis* of values and motives resulted in the predicted two-dimensional structure. Therefore, a new study was conducted in which indicators of values and motives were collected from the same sample.

In this study, 331 subjects from Münster completed a questionnaire consisting of two modules. One of them was a shortened version of the Schwartz Value Survey (SVS). The 44 items of this version had proved to be cross-culturally stable indicators of the respective value types in a multitude of studies (Schwartz & Sagiv 1995). The other module consisted of four scales from the German PRF (Stumpf et al. 1985): *harmavoidance, play, affiliation*, and *achievement*. These scales were selected because they seemed to optimally fit the four poles of the basic value dimensions in the Schwartz model (Table 1). In order to avoid sequential effects of presentation, half of the subjects answered the SVS-items first, the other half the PRF-items. Multidimensional Scaling was applied to scale scores of both instruments.

In a first step, value scores were analyzed separately. The purpose of this analysis was to check whether value types spread in the way predicted by the model (Figure 1). As expected, a two-dimensional MDS (coefficient of alienation $K = .12$) resulted in a perfect reproduction of the expected structure (Bilsky 1998).

In a second step, indicators of values and motives were submitted to a joint MDS. The two-dimensional solution ($K = .21$) shows the predicted structure of values and motives (Figure 4). As hypothesised, all motives emerge in the correct sectors of the plot: affiliation in self-transcendence, achievement in self-enhancement, play in openness to change, and harmavoidance in conservation. In addition, indicators could be split according to the *measurement* applied: All SVS-scores are close to the centre and separated from the PRF-variables by a circular line.

Figure 4 Two-dimensional nonmetric MDS of ten SVS-value indicators and four PRF motives



However, one peculiarity of this last plot needs mentioning: Other than in the separate analysis of value scores, self-direction and hedonism changed their places in this joint projection of values and motives. Since all bivariate correlations are taken into account simultaneously in an MDS, the structure of values has obviously been affected by the introduction of the four motives. However, this is only a minor deviation which does not threaten our central assumption of one common two-dimensional structure of values and motives.

Conclusion

The above analysis of multitrait-multimethod matrices of motives and the joint analysis of motives and values suggest that there exists *considerable overlap* between these psychological constructs. All in all, our results support the supposition that the *two basic dimensions* of Schwartz' (1992) value model, 'openness to change versus conservation' and 'self-enhancement versus self-transcendence', may serve as a parsimonious taxonomy for classifying motives. Additional analyses including both implicit and explicit measures (Bilsky 1998) validate this assumption.

The structural relations between motives outlined in this text may have been concealed in the past due to focusing on bivariate correlations instead of correlational patterns. Furthermore, considering only one or a few motives per study inevitably prevents the researcher from identifying more comprehensive motivational structures.

Apart from methodological considerations, concentration on only a few motives may be problematic from a conceptual point of view as well. It is not by chance, that achievement, power, and affiliation are called the 'big three' in motivational research. These motives have attracted much attention and, consequently, have bound considerable research resources in the past. Yet, they represent only one motivational dimension – 'self-enhancement vs. self-transcendence'. An overemphasis of this dimension necessarily results in biased research at the expense of other constructs like curiosity, play, harmavoidance or order. All of them are representatives of the second basic motivational dimension 'openness to change vs. conservation'.

Finally, the structural findings presented here may serve more pragmatic interests like predicting the *relation* of motives *with other variables* (covariates). Such predictions, for instance, should be facilitated by the fact that the circular ordering of motives does not only reflect categorical distinctions but results from their mutual compatibilities and incompatibilities. Schwartz could demonstrate that the size of correlations with external variables follows a *sinusoid pattern* as values move around the circular structure (Schwartz & Huismans 1995). Given the structural similarities of values and motives, this should hold for motives, too. Consequently, correlations between an external (third) variable and adjacent motives are supposed to be more similar than correlations between an external variable and motives farther apart in terms of the underlying basic dimensions.

To sum up, the focus of this paper was on *motivational structure*, using Schwartz' (1992) value theory as a frame of reference. The identification of shared structures of values and motives seems helpful with respect to both, a *better integration of past findings* from motivational, social, and personality psychology, and an *efficient planning of future research*. Of course, stressing the similarities between values und motives is not to deny that there are also good reasons for investigating conceptual differences of both constructs.

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VALUES OF VETERAN ISRAELIS AND NEW IMMIGRANTS FROM THE FORMER SOVIET UNION: A FACET ANALYSIS[1]

SHLOMIT LEVY & DOV ELIZUR

Abstract: *Grounded on the formal faceted definition of values introduced by Levy & Guttman (1974), a mapping sentence was constructed to define values as guiding principles. Guided by the Facet Theory approach, the perceptual structure of the value system as well as value preferences are reviewed in a comparative perspective: veteran Israelis vis-à-vis new immigrants from the former Soviet Union (FSU). The data are part of a comprehensive study on Israeli society (Levy, Levinsohn & Katz 2002), conducted between June 1999 and January 2000. Two samples were investigated by means of face-to-face interviews: a national sample of Jewish Israeli adults, consisting of 2,466 respondents, and a comparable representative sample of FSU immigrants, consisting of 373 respondents. FSU immigrants attribute less importance than do veteran Israelis to each of the values under study, but they do not differ much in their value preferences. Both groups share a basic similar circular structure of values (a radex) specified by the orientations of the values, thus replicating earlier studies on values. Differences in a few details are discussed.*

Introduction

The concept of 'value' is widespread, but a short review of the literature since the 1950s reveals that the concept remains rather vague. The point of departure of research in an attempt to classify value systems is the assessment of people's relatedness to their actions (see for example Williams' overview in the *Encyclopedia of Social Sciences*, 1968). However, as value systems are multivariate, such assessments are multifarious. Guided by the facet analytic approach we shall reintroduce the faceted definition for values first presented by Levy & Guttman in 1974, and then we shall go on to theory construction in a

1 The authors wish to thank Reuven Amar for data processing and graphic design.

comparative perspective. Value preference and perceptual structure of a value system are reviewed with special reference to the mass immigration from the former Soviet Union (FSU) that took place during the last decade of the 20th century in Israel.

Defining value as a multivariate term

From the beginning of value research in the 1950s, researchers viewed the term 'value' as a criterion for people's actions or conduct (to mention but a few: Kluckhohn 1951; Parsons 1954, 1964; Scott & Scott 1965). Accordingly, numerous varied assessments may be considered to be 'values' as indeed discussed by Williams, Jr.: "The term value may refer to interests, pleasures, likes, preferences, duties, moral obligations, desires, wants, needs, aversions, and attractions, and many other modalities of selective orientation" (Williams, Jr., 1968: 283).

Such an approach led to confusion and vagueness in defining the concept, as pointed out already in 1968 by Albert who, in her writings, adopts the following approach: "For the foreseeable future, it is doubtful whether a definition of values can be produced that embraces all the meanings assigned the term and its cognates, or that would be acceptable to all investigators" (1968: 288).

A number of years later, the concept remained vague in the literature. For example, Rokeach states in his attempt to define 'value' that "To say that a person 'has a value' is to say that he has an enduring belief that a specific mode of conduct or end-state of existence is personally and socially preferable to alternative modes of conduct or end-states of existence" (1976: 160).

Study of change in values over time is an empirical problem. Therefore, as Guttman (1982) claims, inclusion of 'stability over time' as part of the *definition* of the concept of 'value' renders longitudinal research meaningless. However, Rokeach himself continued to claim that his definition is compatible with those suggested by Kluckhohn and Williams who, like Scott, are aware of the issue of dynamics over time, but not as part of the conceptualization. Moreover, in his later years Rokeach himself became involved in research on 'value change' (Rokeach & Ball-Rokeach 1989).

It follows then, that value systems are multivariate – as are most behavioral terms – and their study requires a definitional framework to facilitate a view of this multivariate complexity. The facet approach enables viewing each of the previous attempts at a definition as emphasizing a specific aspect of the multifaceted concept. However, something must hold all these aspects together, and this commonality is sought in terms of the kind of assessment which is the level of *importance* in value research (see discussion in Levy & Guttman 1974, 1985; Levy, 1990).

For scientific progress and accumulation, some formalization must take place. The formal definition of 'value' adopted here is the faceted definition first presented in 1974 by Levy & Guttman (see also Guttman 1982). The approach in this definition places emphasis on the universe of observations for the term – and reads as follows:

"An item belongs to the universe of value items if and only if its domain asks for a (cognitive) assessment of the importance of a

A: { Situational / behavioral } goal in a/n B: { cognitive / affective / instrumental } modality in life area (y)

for C: { itself as a / a more primary } purpose in life area (z), and the range is ordered

from { very important that it should / to / very important that it should not } exist for that purpose."

In accordance with this definition, 'value' is a special case of attitude (see discussion in Guttman 1982; Levy 1990, 1995; Levy & Guttman 1985).

The above definition specifies that the assessment of importance may be regarded as *cognitive* behavior. So of the three possible modalities of behavior, values are restricted to the cognitive. However, the situational or behavioral *goal* (Facet A) whose importance is being assessed may be of any of the three modalities (Facet B). Evidence for this can be seen, for example, from cross-cultural studies on work values (Borg 1986, 1990; Elizur 1984; Elizur et al. 1991).

It is possible to assess the extent of importance of a situation or behavior as an end in itself (guiding principle), or as a means to a more primary purpose (Facet C). It follows then that the meaning of the precept depends on the goal: "important for what?" These distinctions agree to some extent with Rokeach's classification of values (see discussion

in Levy 1990; Levy & Guttman 1985), to which Schwartz & Bilsky (1987) suggested a faceted definition which is but a special case of the above definition. Though being aware of the need for a theory-oriented framework from which values could be sampled systematically for research, in their later works, as well as in most of the studies on values, not much attention is paid to the issue of formality of value definition (for example: Bubeck & Bilsky 2004; Leviatan 2006; Schwartz 1994).

The definitional frame of the study

Having defined the overall concept of 'value', we shall now present a definitional framework for the particular varieties of value items considered here. This will be done by means of a mapping sentence which incorporates the universe of the items and the population studied. The present study concerns values only as guiding principles – namely, each value is assessed as 'an end in itself' rather than as a means for a 'more primary purpose'. The following mapping sentence serves as the definitional framework for values as guiding principles:

Mapping sentence for observations on values as guiding principles

The assessment of respondent (X) of the extent of **importance for self** of a social precept as an **end-in-itself** through

A		B		C
1. internal	**behavior pertaining** to the	1. individual	in **life area**	1. religion
2. external		2. collective		2. family
				3. social-benevolence
				4. work
				5. self-fulfillment
				6. materialism-hedonism

→ R: high to low **importance** of social precept as a guiding principle for self.

Six value domains are differentiated in Facet C of the mapping sentence. Among these, at least two pairs of domains indicate competing approaches. One pair is hedonism-materialism vs. social-benevolence, and the other is religion vs. self-fulfillment. The materialistic-hedonistic values can be interpreted as being basically of an egotistic-personal nature and of a 'taking' ('having') orientation ('making a lot of money', 'having

a good time', etc.), while the values relating to the social domain are of an altruistic orientation, implying 'giving' and benevolence (such as 'contributing to society', 'helping those in need', 'being a good citizen', 'being a good friend'). Hedonism-materialism vs. social-benevolence accords with Kluckhohn's (1951) distinction between egotism and altruism in value orientation. The other pair of domains – religion vs. self-fulfillment – also expresses competing orientations, namely discipline and authoritarianism in religion vs. permissiveness and self-fulfillment. This distinction accords with the contradiction suggested by Schwartz & Bilsky (1987) between restrictive conformity and self-direction. More generally, the value domains can be classified as pertaining either to the individual or to the collective (Facet B).

The above value orientations, as expressed by the value domains, are fundamental for understanding the perceptual structure of value systems.

In addition to the content facets (ABC), the mapping sentence includes the population, labeled '(X)', and the facet of the range of responses – placed after the arrow in the mapping sentence. The research design expressed by the above mapping sentence calls for assigning to each respondent (x) a response of the range (R) for each item. Each respondent (x) has one and only one response in the range for each of the items classified by the elements of the content facets ABC.

Apart from constituting a definitional framework for observations, a mapping sentence also serves as a basis for constructing empirical hypotheses, as will be shown below (a general discussion on the role of a mapping sentence can be found in Borg & Shye 1995; Canter 1985; Guttman 1982, 1992; Guttman & Levy 1981; Levy 1976, 1985, 1990, 2005; Shye & Elizur 1994).

Respondents were presented with eighteen social values as guiding principles. These relate to all life domains specified in Facet C of the mapping sentence, expressing competing value orientations discussed above and pertaining to the individual/collective (Facet B).

Method

Samples

The data are part of a comprehensive study on a variety of aspects of Israeli society carried out by the Guttman Center at the Israel Democracy Institute (Levy, Levinsohn & Katz 2002). The research population is the adult Jewish population (20 years of age and over), residing in all types of communities in Israel (excluding kibbutzim).

The study was conducted on two samples: a national sample of Israeli Jews and a sample of immigrants from the former Soviet Union (FSU).

A national sample of veteran Israelis comprising 2,466 respondents was selected, representing the research population. Only Hebrew-speakers were interviewed. In addition, a national representative sample of the FSU immigrants who arrived in Israel after 1989 was selected. The FSU sample comprises 373 Jewish respondents.

Procedure

Interviewing by means of a structured questionnaire (that was translated into Russian for the FSU immigrants) was conducted in the second half of 1999 until the end of January 2000. Interviews were conducted face-to-face in the homes of the respondents by trained interviewers. Details concerning sampling and field work procedures can be found in Levy, Levinsohn & Katz (2002).

Analysis

The value system is analysed in a comparative perspective from two points of view: (1) value preferences – resulting in viewing the value system in accordance with rank order and (2) the structural perception of the value system.

For the structural analysis we employed the technique of Similarity Structure Analysis (SSA). SSA is an intrinsic geometrical technique for analyzing multivariate data which emphasizes content regions in the space of variables rather than coordinates. In this technique, each variable is treated as a point in a Euclidean space in such a way that the higher the correlation between two variables, the closer they are in the space. The space used is of the smallest dimensionality that allows such an inverse relationship between all the pairs of observed correlations and the geometric distances. Only the relative sizes of coefficients and the relative distances are of concern (Borg & Lingoes 1987; Guttman 1968; Lingoes 1968).

Results

Value preferences

The eighteen values under study are presented in Table 1 specifying the extent of importance attributed to them by veteran Israelis and FSU immigrants.

With the exception of one value, namely, ‘to be observant’, which is considered important only by a minority of both groups, most of the values (12 out of 18) are considered to be

'very important' or 'important' by almost all respondents of both groups (85%-99%). Somewhat fewer respondents, but still a majority (60%-80%), attribute importance to the remaining five values. However, the extreme positive answer ('very important') provides a wider distribution of responses (24%-87% for veteran Israelis and 8%-77% for FSU immigrants). This facilitates a better differentiation among the values, especially because the differences between veteran Israelis and the new immigrants lie in the extreme positive answers. Analysis of the responses of the FSU immigrants suggests that a 'response bias' may be at work, which is expressed in a reluctance to choose the extreme positive category ('very important') in replying to scaled questions. However, the responses of immigrants and veterans mostly coincide in rank order, in spite of percentage differences (see Levy et al. 2002). Therefore the extent of positiveness is analyzed with reference to the percent answering 'very important' (Table 1).

Table 1 Importance of values as guiding principles for Veteran Israelis and for former Soviet Union (FSU) immigrants (percent answering 'very important')*

Value	Veteran Israelis	FSU Immigrants
To honor one's parents	87	77
To raise a family	80	62
To be at peace with oneself	82	48
To be a good friend	71	54
To read and study for broadening horizons	66	51
To succeed in work	67	43
To be free to choose how to behave	64	43
To have a good time	65	37
To be a good citizen	63	29
To contribute to society	58	14
To help those in need	56	19
To believe in God	49	17
To contribute to charity	42	11
To understand other people's view	40	28
To spend time abroad	37	29
To enjoy beauty	32	28
To make a lot of money	24	17
To be observant	24	8

* The values are presented in the order of veteran Israeli percentages.

Inspection of Table 1 reveals that FSU immigrants are differentiated from veteran Israelis in the importance they ascribe to the values. FSU immigrants attribute less importance to each of the values under study, the differences ranging between 10% and 44%. Most striking are the differences concerning values of the social-benevolence domain such as 'to be a good citizen', 'to contribute to society', 'to help those in need', etc. As evident from Table 1, these sharp differences leave only a few 'consensual' values for the FSU immigrants, while most of the values – with the exception of seven – are 'consensual' for veteran Israelis, with the majority of the veterans considering them as 'very important'. Despite these differences, both groups do not differ much in ranking the values, as shown in Table 2, which presents the value rankings for each of both groups again according to the extreme positive answer ('very important').

Table 2 Ranking of values as guiding principles for Veteran Israelis and for former Soviet Union (FSU) immigrants (percent answering 'very important')

Veteran Israelis		FSU Immigrants	
Value	**%**	**Value**	**%**
To honor one's parents	87	To honor one's parents	77
To be at peace with oneself	82	To raise a family	62
To raise a family	80		
		To be a good friend	54
To be a good friend	71	To study to broaden horizons	51
To succeed in work	67	To be at peace with oneself	48
To study to broaden horizons	66		
To have a good time	65	To succeed in work	43*
To be free to choose how to behave	64	To be free to choose how to behave	43
To be a good citizen	63	To have a good time	37
To contribute to society	58	To be a good citizen	29*
To help those in need	56	To understand other people's views	28*
		To enjoy beauty	28
To believe in God	49	To spend time abroad	29
To contribute to charity	42		
To understand other people's views	40	To help those in need	19
		To make a lot of money	17*
To spend time abroad	37	To believe in God	17
To enjoy beauty	32	To contribute to society	14
To make a lot of money	24*	To contribute to charity	11
To be observant	24	To be observant	8

* Ranking of values with identical percentage is specified in accordance with the percentage who answered 'important'.

Family values, such as 'honoring one's parents' and 'founding a family', head the value rankings of both groups – veteran Israelis as well as new FSU immigrants. Self-fulfillment or personal integrity (such as 'to be at peace with oneself' and 'to study for broadening horizons') together with good friendship follow immediately next. 'To be observant' closes both hierarchies. Materialistic-hedonistic values and a few of the social-oriented values are located towards the bottom of both rankings. However, some of the values pertaining to the collective such as 'to contribute to society' and 'to help those in need' rank higher for veteran Israelis than for FSU immigrants. Interestingly, 'to be a good citizen', unlike 'to contribute to society', is found in the middle of both rankings, meaning that FSU immigrants make a sharp distinction between the benevolence-volunteer oriented value 'to contribute to society' and the law-obedient value 'to be a good citizen', which is much higher in their ranking. For Israelis these two values are adjacent to each other in the middle of the ranking. Another outstanding difference concerns the value 'to enjoy beauty' that ranks low for veteran Israelis and much higher for FSU immigrants.

In sum, with the exception of a few details, these two groups share a similar value system in terms of value preferences, despite the lesser importance attributed by the FSU immigrants.

Perceptual structure of values as guiding principles

Interrelations among the values

In order to study the structure of interrelationships among the values, monotonicity coefficients (Guttman 1986) were calculated among the 18 variables. These are presented in Table 3 for veteran Israelis and in Table 4 for FSU immigrants.

The monotonicity coefficients range from -0.54 up to 0.93 for veteran Israelis and from -0.15 up to 0.92 for FSU immigrants, the vast majority being positive for both groups. The highest two pairs of positive correlations for the veterans as well as for the new immigrants are between the two family values (0.88 and 0.92, respectively) and between the two religious values (0.93 and 0.84, respectively). The few negative correlations for both groups are between values representing competing approaches, such as hedonism vs. social-benevolence, or discipline vs. permissiveness. For example, religious values of a discipline-authoritarian orientation correlate negatively with freedom of choice representing permissiveness, albeit the competing approach is much more pronounced for veteran Israelis than for the FSU immigrants (monotonicity coefficients are -.043 and -.054, and -0.14 and -0.03, respectively). However most of the negative coefficients are rather weak. Hence, though values are attitudinal, Guttman's (1982) Positive Monotonicity Law of Attitude (First Law) may not hold because competing approaches may lead to negative

correlations. Similar indications from other attitudinal studies (Levy 1985) suggest that there may be a further condition for the First Law of Attitude to hold, namely, that attitudes towards an object are complementary rather than competing. This condition can be looked upon as a further classification of the single-object condition (Levy & Guttman 1985; see also Levy 1995).

Table 3 Monotonicity coefficients* among values as guiding principles for veteran Israelis

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
To raise a family	1	100	15	13	28	36	55	56	59	32	50	46	5	16	88	54	46	51	52
A lot of money	2	15	100	46	54	18	-5	6	-17	1	5	39	53	42	-2	0	-10	-8	8
Freedom of choice	3	13	46	100	78	55	32	54	-1	29	25	36	51	37	27	-43	-54	-23	31
Enjoy life	4	28	54	78	100	57	37	57	12	26	37	46	64	48	30	-20	-38	-9	38
Broaden horizons	5	36	18	55	57	100	72	68	39	52	53	48	36	21	48	-1	-7	20	47
Contribute to society	6	55	-5	32	37	72	100	71	71	60	66	47	11	9	67	34	29	55	57
At peace with self	7	56	6	54	57	68	71	100	52	51	58	48	22	20	62	18	-3	32	57
To help those in need	8	59	-17	-1	12	39	71	52	100	64	73	40	-8	-11	68	59	58	80	62
Understand others	9	32	1	29	26	52	60	51	64	100	75	34	18	11	33	16	16	48	57
To be a good citizen	10	50	5	25	37	53	66	58	73	75	100	53	17	17	60	27	21	57	66
Succeed at work	11	46	39	36	46	48	47	48	40	34	53	100	58	20	43	27	9	30	77
Spend time abroad	12	5	53	51	64	36	11	22	-8	18	17	58	100	40	3	-22	-37	-13	35
Enjoy beauty	13	16	42	37	48	21	9	20	-11	11	17	20	40	100	8	-16	-26	-12	19
To honor parents	14	88	-2	27	30	48	67	62	68	33	60	43	3	8	100	56	43	54	61
To believe in God	15	54	0	-43	-20	-1	34	18	59	16	27	27	-22	-16	56	100	93	77	23
To be observant	16	46	-10	-54	-38	-7	29	-3	58	16	21	9	-37	-26	43	93	100	78	17
Contribute to charity	17	51	-8	-23	-9	20	55	32	80	48	57	30	-13	-12	54	77	78	100	44
To be a good friend	18	52	8	31	38	47	57	57	62	57	66	77	35	19	61	23	17	44	100

*Decimal point omitted.

Table 4 Monotonicity coefficients* among values as guiding principles for FSU immigrants

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
To raise a family	1	100	18	6	33	32	29	35	30	22	31	45	16	52	92	26	12	21	49
A lot of money	2	18	100	43	58	18	0	6	-8	-4	13	43	50	27	10	-8	-6	-15	4
Freedom of choice	3	6	43	100	58	36	-8	49	-13	40	24	33	24	22	20	-14	-3	-12	27
Enjoy life	4	33	58	58	100	32	20	48	37	37	26	44	62	48	33	8	-3	20	29
Broaden horizons	5	32	18	36	32	100	45	66	56	53	72	63	39	36	51	13	16	27	48
Contribute to society	6	29	0	-8	20	45	100	33	51	39	59	21	13	24	20	50	25	60	29
At peace with self	7	35	6	49	48	66	33	100	44	56	64	47	32	47	50	33	23	25	52
To help those in need	8	30	-8	-13	37	56	51	44	100	68	68	48	33	27	48	59	58	76	54
Understand others	9	22	-4	40	37	53	39	56	68	100	74	44	32	39	38	43	38	46	71
To be a good citizen	10	31	13	24	26	72	59	64	68	74	100	61	39	37	49	29	19	53	67
Succeed at work	11	45	43	33	44	63	21	47	48	44	61	100	70	42	48	28	25	35	60
Spend time abroad	12	16	50	24	62	39	13	32	33	32	39	70	100	41	14	11	6	13	32
Enjoy beauty	13	52	27	22	48	36	24	47	27	39	37	42	41	100	56	11	13	18	44
To honor parents	14	92	10	20	33	51	20	50	48	38	49	48	14	56	100	26	28	25	59
To believe in God	15	26	-8	-14	8	13	50	33	59	43	29	28	11	11	26	100	84	73	26
To be observant	16	12	-6	-3	-3	16	25	23	58	38	19	25	6	13	28	84	100	65	18
Contribute to charity	17	21	-15	-12	20	27	60	25	76	46	53	35	13	18	25	73	65	100	28
To be a good friend	18	49	4	27	29	48	29	52	54	71	67	60	32	44	59	26	18	28	100

*Decimal point omitted.

Structural hypothesis

Structural hypotheses are based on relative sizes of correlations and hence are associated with the geometry of Similarity Structure Analysis (SSA – described above). The general hypothesis of facet theory is that the specification of formal roles for the facets in a mapping sentence provides a rationale for structural theories concerning a correspondence between the elements of the facets and regions of the SSA space representing the interrelations among the variables. The elements of the life-area facet (C) have the rationale for a polarizing facet because there is no notion of order among the life domains; therefore, it is hypothesized that each element of the facet corresponds to a different direction in the SSA space, emanating from a common origin (Levy 1985, 2005).

Having regions go off in different directions from a common origin generates a *circular* order of regions, namely, a *radex* (Guttman 1954). However, unlike in many other issues, in value research there is a partial rationale for a specific circular order of the life areas,

namely: contrasting orientations (discussed above). We hypothesize that, as already cross-culturally confirmed (Levy 1990, 1999; Schwartz 1994; Schwartz & Bilsky 1987), social-benevolence will be polarly opposite to the materialistic-hedonistic area, and that the authoritarian-disciplined religion domain will be polarly opposite to the permissive self-fulfillment and to the materialistic-hedonistic areas (Levy 1990, 1999). It follows, then, that both religion and social-benevolence areas are compatible, hence, their regions in the space are expected to be in proximity or at least on the same side of the circle.

Some may view religion and social-benevolence as relating to the term 'transcendence'. Religion pertains to an impersonal 'transcendental being' (Levy & Guttman 1985); benevolence as suggested by Schwartz (1994) may be looked upon as 'self-transcendence'. However, to classify benevolence as 'self-transcendence' is a culturally dependent moral judgement and hence cannot be part of a definition of 'value types', much like Rokeach's definition of value as an 'enduring belief". This semantic elaboration has nothing to do with the radex theory based on the competing/compatible approaches incorporated in the values.

A further rationale for the circular order relates to whether the values – in each life area – pertain to the individual or to the collective (Facet B), thus partitioning the circular space into two vast regions. The nature of the religion area as a 'transcendental being' (not moral judgement) can be easily incorporated into this Facet (B) of the above mapping sentence to read:

. . . **pertaining** to the {individual, collective, transcendental being} in **life area** (C).

This shows the contribution of formality for theoretical progress.

The Radex Structure of Values

By correspondence between the space regions and the elements of Facet C (life areas) of the mapping sentence, it is possible to observe the scattering of the points for each group, as expected from earlier studies (Levy 1990, 1992, 1999), in a circular structure, namely, a radex (Guttman 1954). The radex structure of veteran Israelis is presented in Figure 1 and for FSU immigrants in Figure 2.

The circular space in each of the Figures is partitioned into six regions emanating from a common origin. Each wedge-like region corresponds to a specific life area. Let us start at the upper part of the veteran Israelis circle (Figure 1) going clockwise, where the order of the wedge-like regions is as follows: religion, family, social-benevolence, work, self-fulfillment, and materialism-hedonism. The circular order for the FSU immigrants (Figure 2) is as follows: work, religion, social-benevolence, family, self-fulfillment, and materialism-hedonism. Hence, for both groups, the above structural hypothesis of polarly contrasting orientations expressed in the life areas is reconfirmed.

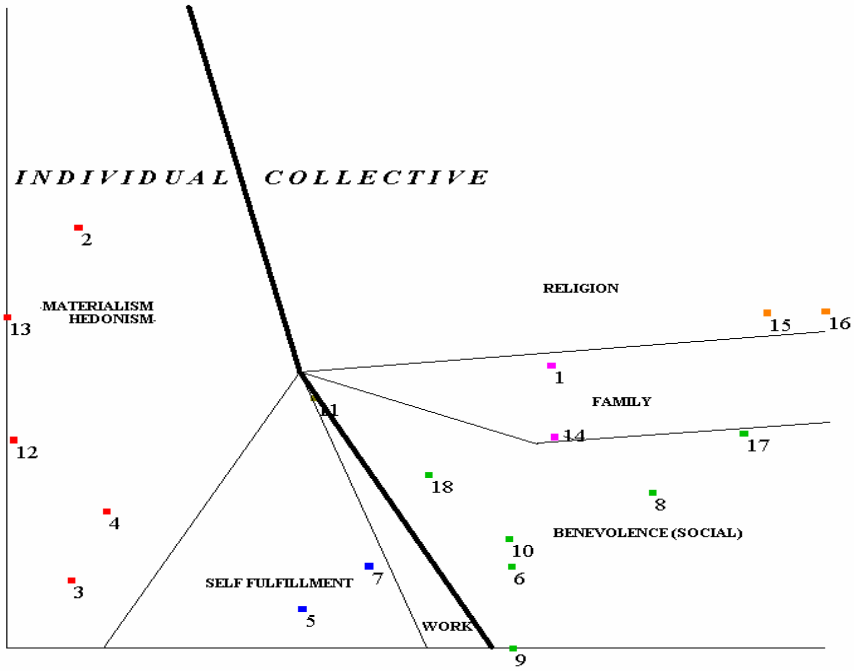
The values related to religiosity, society (benevolence), and family constitute, in both Figures, continuous regions on the right-hand side of the circle, which are, as expected, opposite to self-fulfillment, hedonistic, and work regions at the left-hand side of the circle.

However, there is some difference between veteran Israelis and FSU immigrants with regard to the specific location of the family domain in the right-hand side of the circle. The family area studied here is mainly in the sense of interpersonal, familial relations oriented towards the 'other', and hence its location is at the right-hand side of both circles (see also discussion in Levy 1990). But while for veteran Israelis family values are located between religion and benevolence, for the FSU immigrants family values border on benevolence and self-fulfillment, reflecting also the possible self-fulfillment involved in this domain.

The work area consists of only one value which pertains to the individual, namely, 'succeed at work'. For both groups this value is located close to the origin of the radex expressing its centrality in the respective perceptual structure of values.

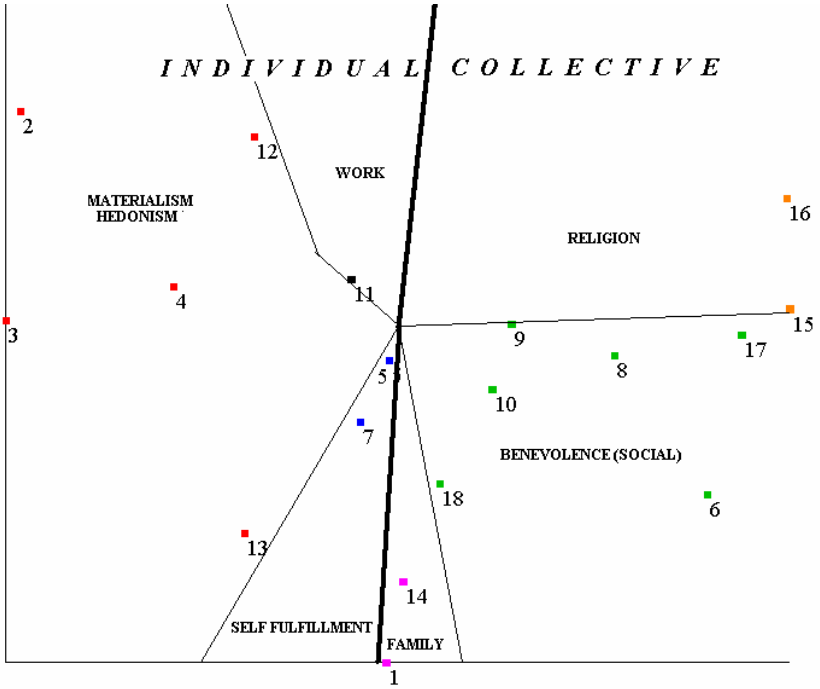
In sum, then, in both spaces values pertaining to the individual (materialistic-hedonistic, self-fulfillment, succeed at work) are opposite to those pertaining to the collective and to a transcendental being. This partitioning, marked by the bold line, is according to Facet B of the mapping sentence, which differentiates between values pertaining to the individual and those pertaining to the collective. Hence, this is a further confirmation of the circular structure of values rationalized by competing orientations of the values (Bubeck & Bilsky 2004; Levy 1990, 1992, 1999; Levy & Guttman 1985; Schwartz 1994; Schwartz & Bilsky 1987).

Figure 1 The Radex Structure of Values for Veteran Israelis



Legend: (1) To raise a family, (2) A lot of money, (3) Freedom of choice, (4) Enjoy life, (5) Broaden horizons (6) Contribute to society, (7) At peace with self, (8) To help those in need (9) Understand others, (10) To be a good citizen, (11) Succeed at work, (12) Spend time abroad, (13) Enjoy beauty, (14) To honor parents, (15) To believe in God, (16) To be observant, (17) Contribute to charity, (18) To be a good friend

Figure 2 The Radex Structure of Values for FSU Immigrants



Legend: (1) To raise a family, (2) A lot of money, (3) Freedom of choice, (4) Enjoy life, (5) Broaden horizons (6) Contribute to society, (7) At peace with self, (8) To help those in need (9) Understand others, (10) To be a good citizen, (11) Succeed at work, (12) Spend time abroad, (13) Enjoy beauty, (14) To honor parents, (15) To believe in God, (16) To be observant, (17) Contribute to charity, (18) To be a good friend

Discussion and conclusions

This article reviews the value system of veteran Israelis and new immigrants to Israel from the former Soviet Union (FSU). These immigrants, who for decades were estranged from Jewish culture, had been in Israel at most 10-11 years at the time of the study (1999-2000), being still in the midst of their acculturation.

Both samples, which were national, are similar with respect to gender and age distributions (the very young group, 20-24 years of age, is somewhat less represented in the FSU sample). However, they differ with respect to their ethnic composition and some SES characteristics. The vast majority (90%) of the FSU immigrants are of European provenance, while veteran Israelis are split almost evenly between those of European-American provenance and of Asian-North African origin (47% and 53%, respectively). FSU immigrants are much better off than veteran Israelis with regard to education (53% and 21%, respectively, have an academic degree), but they are economically deprived (47% and 24%, respectively, state that their monthly income is 'below the average').

Guided by the facet-analytic approach, the definition of values adopted here is the formal faceted definition suggested in 1974 by Levy and Guttman. Leaning on this definition, a mapping sentence is introduced for defining the particular values under study. Accordingly, eighteen values, as guiding principles, were constructed, relating to a variety of domains, expressing competing as well as compatible value approaches. The analysis, which is comparative, concerns two kinds of value perceptions: value preferences and value structure.

Findings indicate that FSU immigrants attribute less importance to each of the values under study; however, both groups do not differ much in ranking the values. Namely, with the exception of a few details, both groups share a similar value system in terms of value preferences. Family and self-fulfillment values head the rankings and being observant terminates both rankings. Hence, though veteran Israelis are not estranged from Jewish culture as much as the FSU immigrants, for both groups this value ranks last. The most striking differences concern the social-benevolence domain pertaining to the collective. Most of these values rank higher for veteran Israelis than for FSU immigrants. Furthermore, FSU immigrants, unlike veteran Israelis, make a sharp distinction between 'to be a good citizen' and 'to contribute to society', with good citizenship ranking as high as for veteran Israelis, and contributing to society, which can be regarded as a volunteer-oriented value, being at the bottom. For veteran Israelis these two values rank next to each other in the middle of the rank order. On the other hand, 'to understand other people's views', which indicates tolerance, ranks higher for FSU immigrants than for veterans.

Only one 'other' oriented value is at the top of both hierarchies, namely, 'to be a good and faithful friend'. Thus, with regard to values with a 'giving' orientation, veterans and immigrants alike differentiate between the individual and the collective, the preference given to the individual rather than to the collective. This difference is much more pronounced for the FSU immigrants than for veteran Israelis.

Veteran Israelis and FSU immigrants also share basically a similar perceptual structure of values, with a few differences in details, in that the respective content facets play similar polarizing roles generating a circular structure of values (radex). The circular order is rationalized by competing orientations, thus replicating earlier cross-cultural studies on values mentioned above (Figures 1 and 2). Two differences between veteran Israelis and FSU immigrants are apparent within the overall similar structure. One concerns the location of the family domain: while for veteran Israelis family values are located between religion and benevolence, for the FSU immigrants these family values are located between social-benevolence and self-fulfillment. For both groups, then, family values border on the benevolence domain, indicating their orientation towards the 'other' ('honor parents', 'raise a family'). However, the location of these family values in the space of the FSU immigrants reflects also the contribution of the family domain to individual self-fulfillment.

The other difference is also related to the issue of self-fulfillment, with regard to the value 'enjoy beauty'. 'Enjoy beauty', in accordance with its definition, is located for both groups in the hedonistic region. However, for the FSU immigrants this value is much closer to the self-fulfillment values than it is for veteran Israelis. Hence, it seems that FSU immigrants emphasize more than do veteran Israelis the self-integrity aspects of a few values, which may be due to their higher level of education compared to that of veteran Israelis. However, the basic perceptual structure, stemming from competing/compatible approaches, remains invariant.

In conclusion, though FSU immigrants are differentiated from veteran Israelis in that they ascribe less importance to the values studied, they share a similar basic value system, with but a few differences, in terms of value structure and preference. The above study shows how lawfulness of human values can be achieved by systematic and formalized conceptualizations leading to cumulative social science. However, much still lies ahead.

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VALUES AND PROPENSITY TO ADOPT NEW HRM WEB-BASED TECHNOLOGIES AS DETERMINANTS OF HR EFFICIENCY AND EFFECTIVENESS: A FIRM LEVEL RESOURCE-BASED ANALYSIS[1]

SIMON L. DOLAN & CHRISTIAN ACOSTA-FLAMMA

Abstract: *This paper explores the usefulness of analyzing a firm's performance from a combination of a web-based human resource view and strategic human resource characteristics. In addressing issues pertaining to HR efficiency and HR effectiveness, the Technology Adoption Life Cycle (TALC) model (Moore 2001) is introduced. The latter helps to classify HR practitioner's adoption behavior along the 'TALC' continuum where HR functions and the web-based HRMS are classified. This classification facilitates a better understanding of the HR information technology and strategic HR relationship. The empirical study is based on a web-based portal in which 192 SAP client-users organizations across 5 continents participated. The findings identify the configurations which add significantly to good or poor HR efficiency and HR effectiveness dimensions throughout the usage and implementation of HR technology. It seems that innovative HR technologies play a strategic and operational role in adding value to the HR department's performance. The results show that when some HR technology functionalities are absent or poorly implemented, there are noticeable consequences for the HR department.*

Introduction

Most companies are doing far better at executing their current activities than at adapting to changes in their business environment. Very few companies can do both well. While the literature on change and adaptation identifies numerous reasons for the lack or fear of adaptation, three barriers to adaptability are deeply rooted in the nature of organizations:

1 Note: This paper is based on the doctoral thesis of the second author (Christian Acosta-Flamma) supervised by the first author (Simon L. Dolan). The authors wish to thank Vicenta Sierra from ESADE for her statistical advice concerning the application of the CHID analyses.

(a) inflexibility in the mental models of their managers; (b) organizational complexity, driven by the demands of execution; and (c) mismatches between current resources and future opportunities.

Overcoming these barriers requires a rethinking of what GE's former CEO Jack Welch has called an organization's 'social architecture' – the bringing together of individual behavior, structure, and culture – which determines a company's long-term performance. Dolan & Garcia (2002) called this adaptation of new values a 'cultural reengineering'.

And if adaptation and renovation is a complex phenomenon to understand within the general organizational context, understanding the same for HR practitioners, especially in innovating in technology for enhancing strategy, has not been dealt with sufficient rigor. The study reported herein focuses on the cross disciplines of change management and decisions about innovations, the use on online technology as the innovation driver, and the role of Human Resource Management in implementing it in view of becoming more strategic. Moreover, the purpose of this paper is to explore the impact of new technologies on HR efficiency and effectiveness and also to better understand the dynamics of adaption of new technologies. The Technology Adoption Life Cycle model (hereafter TALC) is used to position HR departments in utilizing the web-based HRMS for enhancing their respective efficiency/effectiveness.

Research on web-based HRMS adaptation and implementation is scant, anecdotal, and stems primarily from experiences of some firms and/or consultants. It seems that too often decisions to adopt web-based HRMS are driven by network-based effects that built on partnership (i.e., Lepak & Snell 1998) and cost considerations without sufficient attention to strategic issues. Numerous reasons can be identified in explaining why HR managers are having their eyes 'wide shut' toward these fundamental strategic HR issues. For one, many organizations streamline HR activities into information technology and simultaneously downsize their HR personnel. The bottom-line is that innovative HR technology provides more processing power to the end-users, and has a substantial impact on bottom-line results of the firm due to efficiencies in workflows and downsizing (Beheshti & Bures 2000) but not necessarily on strategic issues.

Scholars writing in the field of HR productivity and/or performance have insisted on distinguishing the concept of HR efficiency from HR effectiveness, and by and large the latter was related to strategic implications (Ulrich 1998; Wright 2001). Evidence suggests that the basic HR activities require certain inter-organizational workflows, resources, and capabilities, which can be employed from several resources (Schuler 1992; Walker 1992). As a matter of fact, work of personnel departments described in past decades is characterized by manual handling, up to the point where the organizations began to electronically automate some of these processes in the 1960's (Burgelman et al. 2001).

Due to complexity in programming, capabilities, and limited resources, today HR executives still rely on internal IT professionals to develop and maintain their HRMS. Before the client-server architecture evolved in the late 1980's, every single HR automation process came largely in form of mainframe computers that could handle large amounts of data transactions. Today, by contrast, the same operations can be dealth with directly online with less sophisticated and more user-friendly facilities.

HR executives have a dilemma to solve: on one hand they can *outsource the* administrative HR activities to a third party outside the organization (i.e., traditional functions such as payroll, compensation, benefits, etc.) or be involved in these operations themselves, which requires a set of competences to do the relevant operations internally. By and large, the literature suggests that there are costs and benefits to either option and there is no clear cut advantage to either. The principal argument for outsourcing administrative HR tasks is to free resources from focusing on administrative issues to focusing on strategic issues. In this context, it is argued in this paper that new technologies (including web-based ones) enable a process that we call 'internal sourcing' to technology which may result in freeing HR resources to focus on strategic issues without having the dependencies on outside sources.

Obviously, both HR initiatives – outsourcing and internal sourcing of HR activities – do more than just cut costs and conceal different strategic advantages. Indeed both allow taking benefits of distinctive HR and technical skills and high performances offered to enhance the organization's bottom-line results. While these two distinctive HR options yield similar economic outcomes, it is not only possible, but sometimes preferable, to *internally source* key HR activities into innovative web-based HR applications, as this option provides bigger opportunities for most HR departments to reinforce their strategic capability and position from within organizations.

Looking at HR units in terms of their resource endowments has a long tradition in the HR management field. The analysis is typically confined, however, to categories such as the eight basic HR activities to include 1) HR planning & selection, 2) job analysis, 3) HR coverage to the organization, 4) HR appraisal & evaluation, 5) training & development, 6) payroll, 7) health & safety issues, and 8) strategy & international HR management (Dolan, Valle, Jackson & Schuler 2003).

The idea of looking at newly developed web-based HRM technologies as a principal vehicle to stimulate strategic HRM goes back to the work of Ulrich (2000), but apart from Lepak & Snell (1998), has received relatively little attention. It is argued in this paper that the *integrated web-based HR view of the firm* can provide a framework for addressing some key issues in the HR practice and strategy formulation process to include questions, such as:

a) Which of the current manual and administrative HR routine activities could and should be streamlined into web-based HRMS functionalities to achieve a better cost per processed workflow ratio and greater HR strategy capabilities?

b) Which HR capabilities could and should be further developed to become a reliable strategic business partner to the organization?

c) In what sequence and extent could and should HR be involved in strategic formulation and execution?

d) In what types of firms will TALC users be exploiting the desirable strategic benefits from streamlining HR processes into portal technologies?, and, finally,

e) What is the optimal downsizing / implementation ratio?

Within this context, the following propositions are suggested:

1. Examining firms in terms of their respective TALC behavior may lead to new and different insights than examining the latter from the traditional HR & IT perspective.

2. Aligned with the 'TALC' model one can identify five different types of HR management practices, while some show higher impacts on the organization's bottom-line results through more strategic HRM decision making (see Figure 1).

3. HR strategy for a larger organization involves striking a balance between the exploitation of web-based HRMS applications delivering routine administrative HR services to the workforce's desktops and becoming more involved with the organization's business model and industry setting. In analogy, freeing valuable HR administrative tasks to better concentrate on HR strategic tasks.

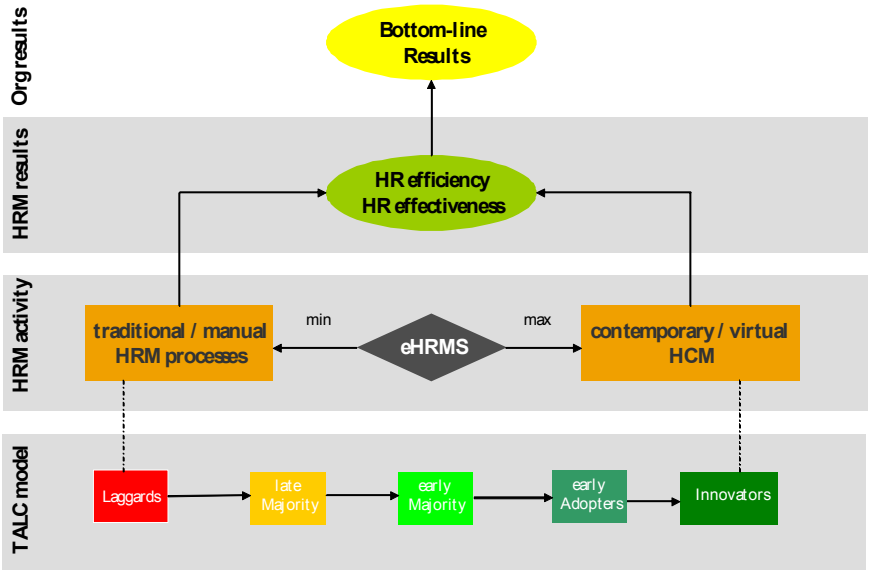
4. The acquisition of a web-based HRMS can also be seen as an acquisition of a bundle of streamlined HR functionalities within a highly complex and global business environment. By basing the purchase on the complete Human Capital Management (hereafter HCM) functionality set of streamlined HR activities into web-based or portal technologies, one can, *ceteris paribus*, maximize both HR efficiency and HR effectiveness levels.[2]

2 Note: Human Capital Management (HCM) is a term used by SAP, a German based multinational software company, as a component of their mySAP ERP HCM product which helps companies align Employees, Processes, and Strategies.

Conceptual framework

The concept of 'TALC' refers to a process by which an organization adopts and responds to discontinued innovations (Moore 2001), such as is the case with web-based HRMS modules. More specifically, an organization's TALC user model at a given time could be divided into five different categories as follows: (1) laggards, (2) late majority, (3) early majority, (4) early adopters, and (5) innovators. In parallel, the HRM practices can also be placed on the TALC continuum, whereby the traditional/manual HRM practice are closely linked with laggard organizations, and the contemporary or virtual HRM practices are linked to innovators representing the other pole. The remainder of the HR practices can be placed in the middle range of the scale. As with most scales employed in the social and behavioral sciences we assume a normal distribution of organizations along this scale. The proposed model is shown in Figure 1.

Figure 1 Conceptual Model



An underlying premise in this study is that, if an HR professional for any given organization is still performing HR routine administrative activities, which is characterized in our model as the traditional/manual HRM pole (see Figure 1), the more the HR practitioner is adhering to manual-administrative mode, the higher the costs associated in executing tasks and the less time to focus on strategic thinking. By contrast, it is proposed that HR activities in a contemporary/virtual HRM environment will increase HR efficiency in managing some core areas and enable to divert the extra time gained to spend more on strategic themes. More specifically, and following this logic, the SAP model, for example, identifies the following four areas where efficiency can be gained in using their technology: 1) Employee Life-Cycle Management, 2) Employee Transaction Management, 3) HCM Service Delivery, and 4) Workforce Deployment.

The following examples will explain more specifically the hypotheses about strategic benefits and respective conditions for the use and application of a web-based technology:

a. If an organization has streamlined HR activities and electronic workflows in place, which allows the usage of web-based technologies to deliver HR services to the entire HCP, then various cost and resource benefits will occur. These *internally outsourced* processes should theoretically lead to more strategic involvement from the HR 'freed' staff.

b. If an organization has not yet streamlined its routine, administrative HR activities into an HRMS module and continues to perform them under the traditional HRM concept, these cost and resource benefits can only be positive if they are *outsourced* to an external HR provider or if labor costs of the organizations Shared Service Centre (SSC) are comparatively low. In this case, strategic involvement could theoretically also be achieved.

It is worth noting that the leading HR scholars today suggest that any HR practitioner or TALC user, who wants to add value to the 21st century firm, needs to become a strategic business partner (Ulrich 1987, 1999), delivering apart from the standard set of HR services unique strategic management solutions from at least the HR focus of the firm. Streamlining HR activities into portal HRMS technologies without a previous analysis of the present and future position on the five different TALC user-model categories can leave the organization and the HR practitioners vulnerable to not achieving immediately the desired results – such as increased HR efficiency and HR effectiveness effects – from this costly transformation process.

Moreover, it is possible to identify five different HRM core practices in relationships to the TALC users. Table 1 summarizes the streamlined HR activities into each HRM core practice.

Table 1 HR activities that can be converted into the HCM technology solution

Note: Examples are used with permission of SAP AG from the HCM solution.

Table 2 TALC – HR functionality matrix

TALC / Functionality	Laggard	Late majority	Early majority	Early adopter	Innovator
Employee Life-Cycle Management	N/A	X	X	X	X
Employee Transaction Management	N/A	X	X	X	X
HCM Service Delivery	N/A			X	X
Workforce Deployment	N/A		X	X	X
Portal Deployment	N/A				X

Note: Terminologies of the functionalities are based on the SAP HCM solution.

The terminology used in Table 2 pertaining to the core HRM practices is by no mean exhaustive. It is a terminology developed by SAP for the HCM solution. Other developers of HRM software platforms use other terms. Nonetheless, an organization which, at a given time, finds itself in some sense ahead of others may use this particular HCM framework for analysis that leads to gradually increasing the amount of HR technology involved in the organization. It is the properties of this analysis on web-based HCM practices and their mode of novel capabilities acquisition which allow this to be done. *What an organization wants is to create a situation where its own HRM practice position directly or indirectly makes it more difficult for others to catch up (i.e., to be idiosyncratic)*. To analyze an attractive web-based HCM practice for a general potential for high returns, one has to look at the ways in which an organization with a strong market and management position can influence the HR function to develop rare and not easy imitable HR practices as well as talent.

In general, one should keep in mind that most web-based HRMS processes are seamlessly integrated into other functional modules of the Enterprise Resource Planning (hereafter ERP) and workflows of the organization. As a result, a given streamlined HRM activity will often have consequences in several other departments of the organization, each yielding part of the results. A routine and administrative workflow such as payroll, for instance, which could be performed more cost efficient using technology, is a good example. The general attractiveness of web-based HRMS applications, understood as its potential to support the HR function, is only a necessary, not a sufficient, condition for a given organization to reassure 21st century HRM practice developing rare and inimitable HR services and HCP talent. Organizations and HR practitioners should opt for gradually streamlining HR activities into HRMS applications, whether client/server or portal technology, and must recognize those HR related workflows, by not only reducing its HR cost structure but also bearing in mind the potential to use freed HR resources for additional strategic HCM issues instead of downsizing or externalizing the function as a whole.

The above discussion raises some fundamental HR issues to which organizations and HR executives need to address: can they get higher returns by implementing web-based HRMS modules? Overall, the innovator advantage – high impact TALC position – should yield high returns for the stakeholders of an organization were the utilization of web-based HRMS applications is dominating over the manually processed workflows. Thus, information was collected and analyzed attempting to address this question. Two main themes were articulated: (1) which of the HR functionalities corresponding to each of the five TALC user groups is used by the firm (data was based on the 'mySAP ERP HCM solution'); and (2) what is the level of HR efficiency and HR effectiveness that HR professionals achieve by *internally outsourcing* these HR activities and processes into the 'mySAP ERP HCM solution'? The latter formed the basis for the empirical data sources and enabled comparative analyses which are presented hereafter.

Methods and procedures

Data was furnished by Top Management, senior HR Managers, HR Professionals, HR Systems, and Line Managers who are familiar with the 'mySAP ERP HCM solution' and also with the HR operations in their respective organizations. More specifically, these individuals assume to act as gatekeeper sources for their firm. By filling up an online questionnaire, information was gathered regarding: (1) streamlined HRMS functionalities, (2) perceived level of HR efficiency, (3) perceived level of HR effectiveness, (4) perceived impact on bottom-line results, and (5) perceived level of strategic involvement, when innovative HR technologies are being introduced to the HR function.

Measures and instruments

Using an online survey among SAP worldwide users, questions were directed toward measuring (1) the level of implementation behavior on HR functionalities within organizations and their respective HR departments, (2) the perceptions of HR efficiency and HR effectiveness, and (3) how new HR technologies satisfy and change HR professionals involvement as being critical to firm performance. Given the number of dimensions to be measured coupled with the requirements for internal reliability, the usual format of standardized questions and Likert-type scales (0-6 range for most items) was employed. Data was gathered during the Summer/Autumn of 2004. For strategic considerations, an attempt was made to keep the questionnaire relatively brief, as otherwise the response rate would have been affected.

The TALC measure: Based on an HR functionality matrix (see Table 3) the TALC model was operationalized. The checked entries indicate the implemented HR functionalities streamlined into HR technology applications. The count of the relative number of HR modules technology implementation was used to classify companies along the 5 categories:

Table 3 Solution functionalities

Based on "mySAP ERP HCM "	Implemented	Planned
Personnel Record & Administration	❒	❒
Payroll	❒	❒
Benefits	❒	❒
Organizational Management	❒	❒
Time Management	❒	❒
Travel Planning & Travel Expense Management	❒	❒
E-Recruiting	❒	❒
Performance & Appraisal Management	❒	❒
Compensation	❒	❒
E- Learning	❒	❒
Training & Employee Development	❒	❒
Manager Self-Service	❒	❒
Employee Self-Service	❒	❒
Employee Collaboration	❒	❒
Reporting & Benchmarking	❒	❒
Health & Safety	❒	❒

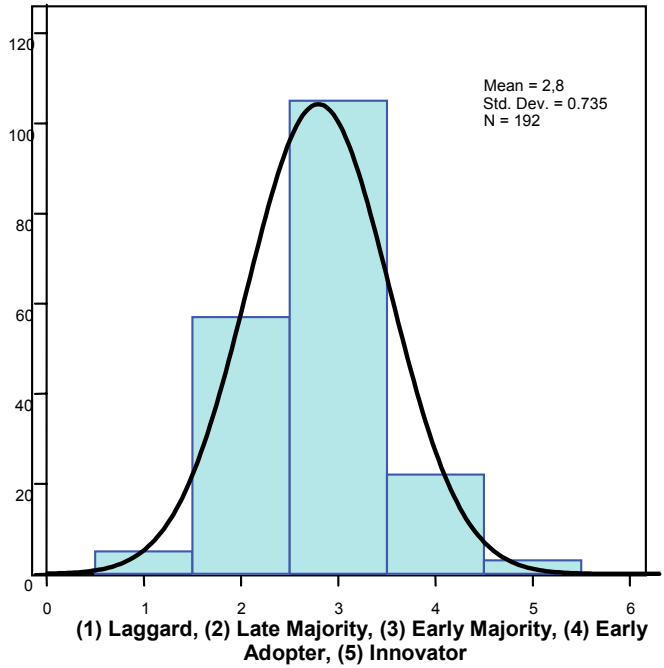
The **Laggards** are companies that neither consider usage of technology in their line of business nor have externalized/outsourced major HR activities to third party HR providers; the **Late Majority** adopted up to two core HR functions; the **Early Majority** have implemented, besides the previously described core functionalities, the **'Workforce Deployment'** functionality, which is structured in the following HR sub-functionalities: project resource planning, resource and program management, call-centre staffing, and retail scheduling; the **Early Adopter** users are true revolutionaries in business (Moore 2001) who employ a broad set of HR sub-functionalities, which includes Manager Self-Service (MSS), Employee Self-Service (ESS), Employee Interaction Center (EIC), and Alternate Delivery Channels (ADC). In a nutshell, the Employee Interaction Center connects HR professionals with employees through a HR call-centre or help-desk application, based on a shared service model; finally, the **Innovators** are the technology enthusiasts who are fundamentally committed to the new HCM technology by employing the latest technological advancement, portal technology deployment, and adopt all HCM core functionalities to be included into the web-based HR application.

The distribution of the TALC model in the sample is described in Table 4 and Figure 2.

Table 4 Distribution of the Sample with the TALC Model

	n (#)	Valid Percent	Cumulative Percent
Laggards	5	2.6	2.6
Late Majority	57	29.7	32.3
Early Majority	105	54.7	87.0
Early Adopters	22	11.5	98.4
Innovators	3	1.6	100.0
Total	192	100.0	

Figure 2 Frequency of the HR TALC



HR Efficiency included two dimensions which resulted from factor analyzing the original items that made up the concept (see Table 5). These two dimensions were established in order to differentiate whether HR efficiency could be derived from process-harmonization/transformation issues, and whether the overall effects on HR efficiency could be tracked appropriately. A 6-point Likert scale was applied to each dimension. The **'HR Efficiency – Process Transformation'** was based on responses to whether the process of transformation of new HR technology had an effect on: (1) cost per process output, (2) time per process output, (3) cost/budget of HR function, and (4) overall HR ratios.

The **'HR Efficiency – Track Advantage'** was based on the extent to which HR professionals were able to take advantage of the SAP HR technology investments to track: (1) operational performance, (2) employee performance, (3) supplier performance, (4) customer behavior/satisfaction, and (5) human capital.

Table 5 Overview of HR efficiency and HR effectiveness

Group item	Factor number	Factor Name	Total variance	% of variance
HR efficiency	1	Process of Transformation	2.891	72.263
		Take Advantage	3.042	60.844
HR effectiveness (IMPACT)	2	Departmental	6.85	57.15
		Organizational	2.17	18.074
HR effectiveness (INVOLVEMENT)	3	Strategic	7.019	35.093
		Administrative	2.959	14.797
		Operational	1.862	9.309
		Coaching Workforce	1.138	5.692
		Process Redesign	1.056	5.281
HR effectiveness (SATISFACTION)	4	Solving Routine HR Admin	4.31	53.9
		Contribute to the Bottom-Line Results	1.21	15.11

HR Effectiveness (hereafter HRE) was measured using three dimensions as described hereafter, also resulting from factor analysis (Table 5). A 6-point Likert scale was applied to each dimension. **'HRE – Impact'** was based on responses to whether the process of transformation of new HR technology had an effect on the organization, and on the departmental effectiveness. **'HRE – Involvement'** was measured by tapping respondents answers to the extent of which HR personnel was involved in about twenty activities. **'HRE – Satisfaction'** was measured by asking how satisfied HR professionals were that the SAP HR technology allowed them to perform certain activities.

Sample characteristics

Of the 192 respondents, 59 were executives in HR systems, 31 HR professionals (specialist, generalist, administrative), 22 heads of HR systems, and 15 directors of HR services. In addition, 56 respondents (28 percent) were other Senior HR executives or line managers.

The majority of respondents (41.5 percent) were from the United States, followed by the German speaking countries (i.e., Germany, Austria, Switzerland – 13.3 percent), BENELUX (9.2 percent) and Spain, Portugal, and France (8.7 percent).

Results

Bivariate Analysis

Overall, the ANOVA results show that from among the two possible dimensions that might affect HR efficiency, 'Taking Advantage' plays a major role. This trend is sustained in the subsequent analysis of the basic HR activities with respect to HR efficiency and HR effectiveness. The ANOVA results suggest that the use of innovative HR technology has an effect on both HR departmental and organizational effectiveness. Looking more closely at HR effectiveness – impact, the findings suggest that HR practitioners seem to be able to better perceive the immediate effect on HR departmental effectiveness rather than on organizational effectiveness. The ANOVA findings on HR effectiveness – involvement illustrate that from among the multiple blocks of items, the item operational involvement has the most important role, followed by coaching the workforce and process redesign. Although the item strategic involvement showed no significance for the sample, the item operational involvement includes strategic business partnering as an area of major HR involvement. In more concrete terms and despite the use of a somewhat different operational criteria and study design, these findings corroborate findings reported in the literature. In addition to HR effectiveness – impact and involvement, ANOVA results on satisfaction show that there seem to also be a contribution to the bottom-line results when innovative HR technology is used more extensively, especially the contrast between Early Adopter and Innovator TALC user groups. The relationships between the TALC model and HR efficiency as well as HR effectiveness reported in this study have been found to have a positive effect on organizational and HR departmental productivity.

Multivariate analysis

A 'Decision Tree Method' in combination with a regression and classification algorithm (CHAID) for multivariate analysis was used. This technique identifies configurations and profiles for predicting the criteria (HR efficiency and HR effectiveness). Only results with significant coefficients are presented here (see Figures 3 and 4). Also, note that while many trees were identified, only those 'branches' with the most significant findings are presented herewith.

Figure 3 HRE-Solving Admin to Free HR Time

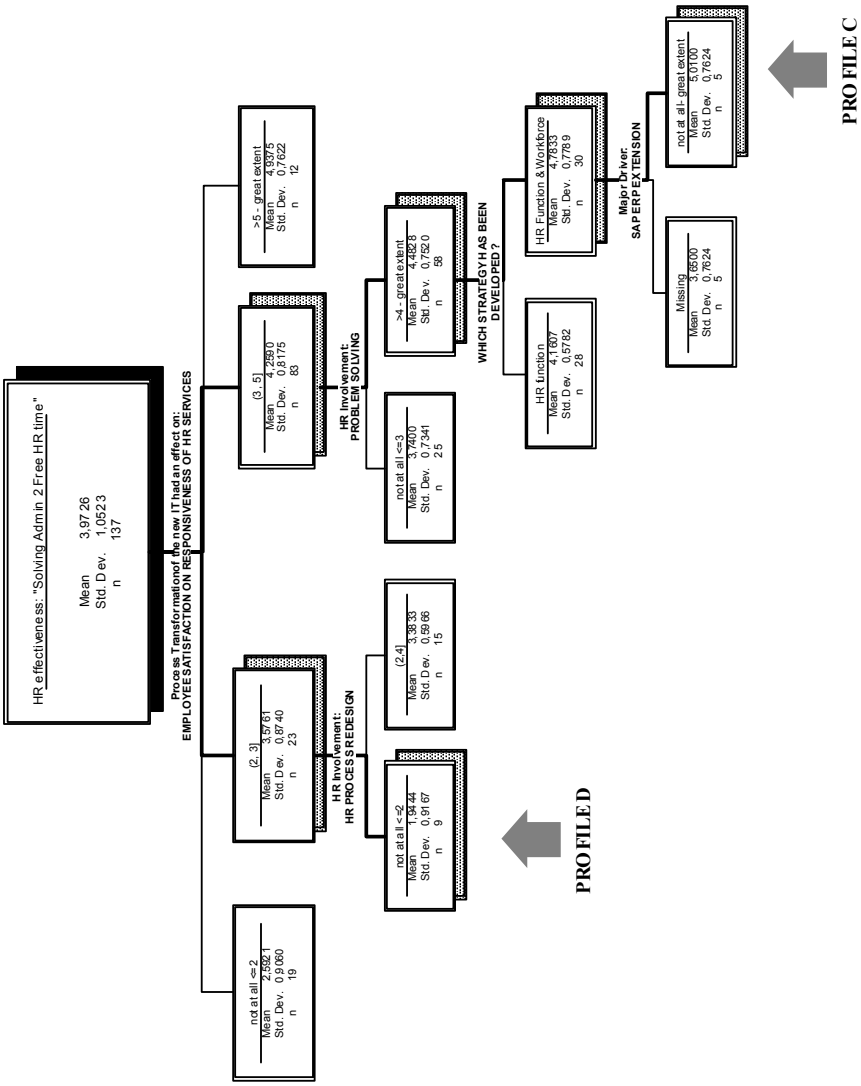


Figure 4 Process of Transformation– cost per process output

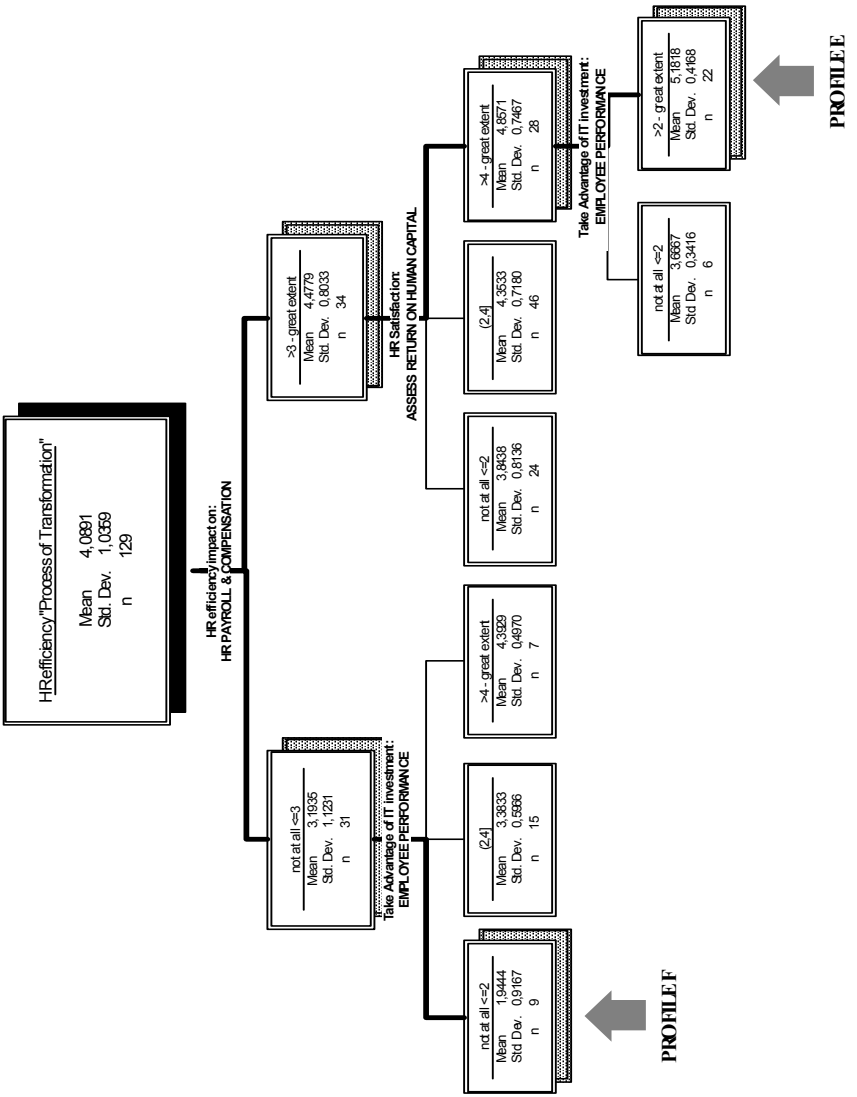


Figure 3 shows the tree model for the HRE **'Solving routine HR administrative work to free HR practitioner's time to focus on strategic issues'**. The global explained variance of the configuration depicted in Figure 3 amounts to 68.37%.

Profile 'C' (explaining **'Solving Admin to Free HR time'** as a criterion) suggests the following configuration: This branch includes firms which show their employee satisfaction from responsiveness of HR services to have higher scores (on a 6-point Likert scale), they value their HR involvement as 'Problem Solving' after the new HR technology has been implemented, and they have developed and implemented both a strategy for the HR function and a strategy for the workforce. Starting from an initial mean of 3.97, the techniques help to improve the prediction up to a mean of 5.01, and 1.03 respectively or increasing the prediction by 26% on the criterion).

Profile 'D' identifies the opposite configuration (on **'Solving Admin to Free HR time'**). This configuration D identifies the following combination: 1) Firms employee satisfaction on responsiveness of HR services are low (i.e., below 5 on a 6-point Likert scale) and 2) score low (below 3) on valuing their HR involvement 'HR process redesign' after the new HR technology has been implemented. This set of combined variables improves the explained mean by an additional 27%.

With regard to the second factor, Figure 4 shows the tree model for the HR efficiency 'Process of Transformation – cost per process output' variable. The total variance explained by this configuration amounts to 74.85%.

Configuration 'E' explains high scores on the **'Process of Transformation– cost per process output'** – Configuration E includes firms for which 'HR Payroll & Compensation' are satisfied and firms who are able to take advantage of their HR technology investments to track 'Employee Performance'. Using this configuration, the prediction is improved by 27%.

Configuration 'F' explains low scores on the **'Process of Transformation– cost per process output'** – Configuration F includes the following: 1) Firms which have had low score on HR efficiency impact on the HR activity 'HR Payroll & Compensation' and (2) are able to take advantage of HR technology investments to track 'Employee Performance'. This set of combined variables increases the prediction by 52% (from a mean of 4.1 to 1.9) on the criterion of the Process of Transformation – cost per process output.

Discussion and conclusion

The findings focus on the links between innovative HR technology and their strategic implications for Human Resource Management. While the bivariate analysis (using the ANOVAs) provides some explanation, more interesting results emerge from the multivariate analyses. The configurational predictions presented here are based on the assumptions that implementing Human Resource Management Systems (HRMS) within the HR department will result in higher HR efficiency and HR effectiveness and will ultimately contribute to the bottom-line results of an organization. The findings identify the configurations which add significantly to good or poor HR efficiency and HR effectiveness dimensions throughout the usage and implementation of HR technology. It seems that innovative HR technologies play a strategic and operational role in adding value to the HR department's performance. The results show that when some HR technology functionalities are absent or poorly implemented, the detrimental consequences for the HR department could be devastating. To some extent, these results are in line with what numerous researchers, HR consultants as well as HR vendors, have suggested. The method used to examine this net effect was borrowed from the data-mining field and helped to detect various profiles (i.e., best performance and worst performance) containing different configurations of HR technology and HR activities related to the implemented HRMS functionalities. Within these configurations, the high-performing organizations use advanced HRM strategies and contemporary/virtual HR practices in order to affect the bottom-line.

This paper attempted to look at HR departments in terms of their TALC profile and connect it to the emerging literature on the HRM-resource-based view of the firm. (Colbert 2004). This TALC taxonomy can prove instrumental to firms and HR professionals considering an 'internal outsourcing' of administrative HR tasks to the newly developed web-based HR technologies as vital delivery channels for their HR services (Vosburgh 2003), thus freeing valuable time of the HR professionals to advance strategic responsibilities.

Furthermore, this paper explores the relationships between various streamlined functionalities into HR technology applications and strategic HCM in organizations using the TALC model for evaluating the current status of the implementation. Some elements are borrowed from the resource-based view of the firm as the linking pins (Colbert 2004; Wernerfelt 1984). In this sense, apart from the obvious need to look at how exactly the different TALC users can be related to HR efficiency and HR effectiveness and finally contribute to the bottom-line results of the organization, the message in this paper is that, despite the need for more empirical research to test the implementation of the TALC model, the proposed conceptual framework can be most instrumental to position the HR department in their adoption behavior. Very little and controversial conclusions emerge

from studies examining the trade offs between gain and losses when HR efficiency is enhanced and downsizing occurs (Dolan et al. 2000). Nevertheless, the leverage of HR effectiveness due to usage of new HR technologies, (i.e., web-based applications) has until now not been studied systematically by scholars.

When innovative HR technology is in place, a better formulation and decision making structure can be derived. The potential use of these new technologies can enhance both efficiency and effectiveness of the HR department.

In practical terms, HR executives applying the TALC model while handling complex IT topics such as implementing, streamlining, reengineering, and upgrading HR functionalities in the organization can extend their body of knowledge and expertise in their day-to-day vocation. Thus, they can make more progress in their strategic HCM development, along with the increasingly common tendency of companies to integrate their Enterprise Resource Planning (ERP) with HR. It may help them to align innovative HR technology with their idiosyncratic HR practices in a step-by-step approach in line with their technological knowledge and responsiveness, permitting a better usage of financial, strategic, and human resources within the department and the firm. Furthermore, they can use the 'TALC – HR Functionality Matrix' as a practical project-planning tool for their individual HR technology-implementation purposes in accordance with their profile and their willingness to dramatically change their past behavior (i.e., traditional/manual) with the promise of gaining equally dramatic new benefits at a contemporary/virtual HCM level.

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NON-HIERARCHICAL EMERGENT STRUCTURE: A CASE STUDY IN ALTERNATIVE MANAGEMENT

SANJAY T. MENON

Abstract: *Most well established organizations beyond a certain size adopt a hierarchical structure and accompanying bureaucracy as a means to organize and coordinate the work of the organization. This case study describes a medium-sized family-run organization in the US, with 600 employees and $2 billion in sales turnover, which functions without formal management structures or titles. Data collected through personal observation and interviews reveal emergent structures, partly in response to the alternative management approach. The paper describes these alternative management methods, the advantages and disadvantages, as well as the conditions that make this approach possible. The paper concludes by discussing the transferability and suitability of these methods to organizations in general.*

Introduction

Many new organizations, especially start-ups, begin life with a rudimentary structure, with the owner-manager directly supervising a small number of employees, often working alongside with them to produce the goods and services that define the organization. Greiner (1998) refers to this phase in the organization's life as the creativity phase, where the focus is on producing and creating a market for the good or service based on a new idea. The founders, often themselves exiles from large corporations, deemphasize managerial or bureaucratic processes. They favor informal, direct communication with employees, and paperwork or documentation for its own sake is negligible. Mintzberg (1979) has referred to the structure of such organizations as the simple structure, where the owner-manager directly supervises and makes all important decisions. As the organization grows, however, full-time managers must typically be hired to manage and motivate the much larger workforce. Larger operations would need to be formally coordinated and formal controls, both financial and non-financial, would need to be instituted. Over time, most medium and large organizations mature into well structured bureaucracies with formal titles and reporting relationships,

technical specialists and professionals managing various operations, a hierarchical structure with many layers offering career progression, professional human resource management, and formal communications, paperwork, and documentation. Typically, this relatively stable structure evolves as the organization responds to periodic and often opposing demands for formalization and standardization, unit level autonomy, and coordination of disparate units, which naturally accompany growth (Greiner 1998). At the level of the individual job, a detailed job description forms the basis for hiring, training, compensation, and performance appraisals. Individual performance is managed through a system of intrinsic and extrinsic incentives with formal, written annual performance reviews.

There are many advantages to the relatively stable, albeit bureaucratic structure. The formal hierarchical structure with titles signifying authority and function provide an organizing framework for the work of the organization. The structure formalizes the necessary division of labor needed in a large organization, while simultaneously serving as a coordinating mechanism which ties together the various tasks of the organization into a coherent whole. Responsibility, authority, and communication lines are clarified ideally resulting in an efficient, well oiled machine described by Max Weber (1921). It serves to bring order to a large group of people with rules and procedures. Formal written communication and documentation creates institutional memory and helps with continuity and renewal. The formalization and standardization helps to separate positions from incumbents, lessening abuses of power and arbitrary decisions. All in all, the formal structure and accompanying bureaucracy provides an efficient, rational, and legally defensible method for managing complex organizations.

Despite these advantages, formal structures and bureaucracies are more often than not faulted for being overly formalized and bureaucratic to the point of adversely affecting organizational effectiveness (Shaw & Schneier 1993). Procedures and paperwork can slow down decision making and response time. Overemphasis on adherence to procedure may come at the detriment of action and results, and creativity may be stifled. The formal division of labor and departmentalization with accompanying unit- or departmental-level performance measures could lead managers to pursue departmental goals at the expense of overall organizational goals, encouraging turf battles rather than collaboration. At the individual level, detailed job descriptions can lead to the 'not my job' syndrome, where employees limit their contribution only to activities that are formally sanctioned, measured, and rewarded.

Thus, while the typical organization structure and work arrangements have obvious advantages, it is a mixed blessing. In the absence of deliberate intervention, most organizations will evolve into some variation of the structure described above. The challenge in modern organizations has been to adopt designs that minimize the weaknesses of these traditional bureaucratic structures, while retaining the advantages. According to Nadler & Tushman (1999),

organizations will have to meet the dual challenge of responding to the changing environment in a flexible manner while being strategically integrated and coherent. There is need for both controllability and responsiveness (Graetz & Smith 2005). Increasing flexibility and speed of response requires an accompanying reduction in bureaucracy and red tape as well as redesign around processes for customer deliverables. Typical approaches include flattening the organizations by eliminating hierarchical layers; minimizing paperwork and streamlining procedures; increased professionalism and training of employers; breaking up large organizations into more manageable units; performance management through cultural norms and expectations rather than rules and sanctions; and using team based structures.

While these measures help reduce some of the problems associated with excessive bureaucracy, they do not eliminate them. This is to be expected, as in most organizations there is a limit to which bureaucracy can be reduced. This paper describes an organization that has pushed this process to the extreme. In this unique organization with more than 600 employees, most have no job titles or job descriptions. Officially, there are just two levels – senior management and employees. There are no formally scheduled meetings or formally scheduled evaluations. There is no separate HR department and minimal internal paperwork. Communication is mainly by phone or e-mail. This is not a typical organization, but its workings provide insights that can be potentially applied in other settings. This paper is essentially a case study of this organization describing its unique structure, culture, and operations. It represents an alternative approach to management and organization. The paper evaluates the design represented by this organization in terms of the conditions that make it possible and its generalizability to organizations at large.

Medical Distributors, Inc.[1]

Medical Distributors, Inc. is an independent, family owned regional distributor of pharmaceutical and medical products, in business for more than 150 years in the southern United States. Till about 1980, it had only about 60 employees and maintained a close-knit family atmosphere. When the pharmaceutical distribution industry began to consolidate and large national distributors emerged, Medical Distributors (hereafter referred to as MD) had to grow rapidly to avoid takeover and stay competitive. New customers and employees were added at a rapid rate and by the turn of the century, MD had grown into a medium-sized company. At the time of this writing, the company operates out of a brand-new, expansive warehouse with the latest custom-built automation, employing over 600 employees and grossing more than $2 billion in sales, putting it within striking dis-

1 Actual name withheld at the company's request.

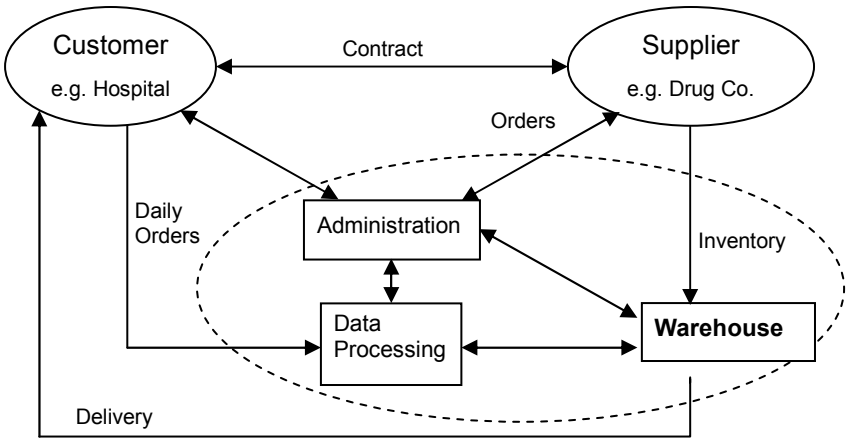
tance of the Fortune 500 list of largest companies in the US by sales volume. This phenomenal transformation has been mainly through internal growth. Employees are well paid and to date there has been no attempt at unionization.

What makes this company an interesting case study is that the organization has managed to stay relatively free of the formalized structure and bureaucracy that typically accompanies growth. It has managed to retain many elements of an informal family atmosphere, despite a 10 fold increase in workforce. As mentioned before, most employees do not have titles or written job descriptions. Following an overview of operations, these and other alternative management elements are described and discussed below.

Operations overview

The company is essentially a warehousing and distributing operation. It distributes over 40,000 product items that include prescription drugs, over the counter medications, and health and beauty products, to hospitals, independent and chain pharmacies, and nursing homes. The service coverage area extends over eight southern states within overnight driving distance. All deliveries are by truck making it one of the largest trucking operations in the state of operation, logging more than 7000 miles per day.

Figure 1 Operations overview



A schematic view of the operations is provided in Figure 1. A large customer with a daily need for a variety of pharmaceutical products typically negotiates contracts with individual manufacturers or suppliers for delivery at a certain price. The actual quantities needed vary from day to day. The manufacturers or suppliers send supplies in bulk to the distributor, MD, which in turn delivers them in the quantities needed every day. Customers place orders everyday and receive deliveries from MD the following day. MD procures stock from suppliers at a discounted price and delivers to customers at the negotiated contract price.

As can be seen in Figure 1, internally, there are three main operational units. The administration unit is at the center of the network. It negotiates price and delivery terms for inventory with suppliers, manages the relationships with customers including billing and customer service, and oversees the operation of the data-processing unit and the warehouse. It also handles accounting, payroll, and human-resource activities such as recruitment and selection. There is also a sales operation in charge of signing up new customers and retaining existing ones. The data-processing unit is a vital part of the operations. Typically, customers place daily orders directly with data processing electronically through special devices installed at the customer location. Custom software then converts these orders into retrieval and shipping instructions for the warehouse. Data processing maintains inventory and operations data including performance data (e.g. error rates), in addition to vendor, customer, and employee records. The warehouse performs the typical operations of receiving inventory, stocking, retrieval, and order fulfillment, culminating in shipping and delivery to customers. There is one main warehouse and several small depots in outlying regions.

Workflow and scheduling

In the warehouse, the first shift workers arrive between 6 and 8 am. There is no fixed time for the start of the shift. The main activity at this time is to receive incoming inventory and finish up with any early morning local deliveries. As the morning progresses, the focus shifts to stocking the inventory and by early afternoon retrieval and order-fulfillment activities commence. Second-shift workers, who are mainly responsible for assembling individual orders and the bulk of the shipping, are expected to be in around 2 pm, but may arrive as early as 12 pm and help the first-shift workers who are finishing up with the stocking. As delivery time at the destination is fixed (early morning), shipping is sequenced according to distance, with the trucks traveling farthest leaving first around 8 pm, and local deliveries leaving only the following morning. This in turn means that customers farther away have earlier deadlines to place their last orders. The bulk of the order fulfillment and shipping takes place between 5 pm and 10 pm. Second-shift workers do not leave until all orders are fulfilled which could be as late as 1 am on busy days. Third-shift employees start arriving at 8 pm and are all in by 10 pm. They help the second

shift finish up and then do maintenance and clean-up activities. Early in the morning inventories start arriving and they start receiving operations till about 6 am when first-shift workers begin arriving. Thus, there is considerable overlap between shifts and workers are not confined to a particular task.

Administration and most data-processing staff work normal work hours from 8 to 5 pm in a separate building. Some data-processing employees are available during the second and third shifts to handle technical issues that may arise.

Technology

Operations are highly automated. Imported custom-built retrieval systems automatically 'pick orders', i.e., fulfill a customer order by retrieving required items and assembling them in a carton for shipping. Most customer orders are transmitted electronically and update a database in data processing. Custom software verifies the order and transmits it to the warehouse computer. The computer sequences orders and activates the automatic retrieval system and prints out labels for each order with barcodes for customer and product information, route, number of boxes, etc. A system of conveyors helps in moving customer cartons from the starting point of assembly operations to the shipping point passing by all stations, with the barcodes activating the needed retrieval. For regular customers the system suggests replenishment orders based on usage patterns. The system maintains inventory records and updates automatically upon retrieval. All units including outlying depots can view inventory in real time. Some smaller custom orders are picked manually, and some retrieval machines have to be stocked manually. All orders are verified by checkers who scan the picked items to cross-check against the customer order.

In addition to customer inventory and customer data processing, the system also tracks employee performance. Any time an item is handled or an operation is commenced, the employee number is also scanned in. Thus, each employee's 'production' can be tracked in terms of number of items handled, boxes loaded, etc. Errors can be tracked to the individual employee who handled the item or performed the action.

Organizational structure

There are only 3 formal titles in the entire company! Top management consists of the President and two Vice Presidents, one in charge of operations and the other in charge of sales and marketing. No other employees have formal titles. Technically (for legal purposes), all the employees report to and in theory are directly supervised by the two vice presidents. With the employment-at-will system in the US, this arrangement protects the company from potential lawsuits by employees, especially since there are no job descriptions or formal performance

appraisals. In practice, there is a layer of middle management that oversees the day to day operations of the company. Though there are no formal titles, there is a production manager, sales managers, and a transportation manager. Employees refer to them as such. Junior management consists of shift supervisors and team leaders, again without formal titles.

Administration is split up into several areas such as contracts, customer service, accounts receivable, accounts payable, and marketing. Again there are no formal titles or separation into departments. There is no separate human-resources department. Payroll is handled by accounting and other HR tasks like recruitment and selection or performance management come under the purview of operations. Staff is kept to a minimum and no one except the top management has support staff like secretaries.

Emergent structure

In any group of people, structure emerges even when not formally sanctioned and MD is no exception. Though individuals lack formal position power, they accrue other bases of power such as expert, referent, reward, and coercive; the latter two being informal and non-monetary. Individuals with longer tenure and /or expertise gain expert and referent power. In each area, typically, a senior person gains nominal authority to direct work activities. For example, in accounts receivable, a senior person who has been with the company for 25 years directs the work of one other employee with 10 years experience and a trainee with less than six months tenure on the job.

In the warehouse, the workflow determines groupings of employees. As described earlier, the basic activities are receiving, stocking, order picking, verifying, and shipping. In each of these areas there are team leaders who emerge not only due to their expertise in their particular area but also due to their understanding of operations as a whole. The entire operation is tightly linked and delays, errors or breakdowns in one area can affect the entire process. Those who understand these linkages have a broader perspective and emerge as leaders. Over time, with experience, a team leader might begin to coordinate more than one area and emerge as a shift supervisor. This is not automatic. For example, currently the first shift has no shift supervisor but has a number of team leaders. The second shift on the other hand has a supervisor and team leaders. Again, no one has formal titles. The production manager is in charge of overall warehouse operations as well as issues such as employee evaluations, disciplinary measures, and miscellaneous tasks such as facility tours. In addition to these recognized positions, there are informal leaders and resource persons. In most areas there are veteran employees who prefer to work in line positions rather than assume leadership responsibilities, but nonetheless exert moral authority by virtue of their experience. These senior employees set standards for workplace behavior and performance. They model the

work ethic the company expects and often mentor new employees. An individual may also emerge as a resource person by virtue of particular interests or expertise. For example, a person who likes working with machines might get involved in maintenance activities and may emerge as the troubleshooter for a set of machines.

Thus, despite the lack of formal titles on paper, there is a definite structure to the entire organization. But because nothing is formalized, the structure is very fluid. As there are no rigidly defined areas of responsibilities, roles emerge as needed. For example, an individual who was hired for his expertise in transportation contributed to software development as he had prior experience and interest in that area. Personnel can also be moved at a moment's notice from one area to another. For example, employees who are stocking may be called upon to finish up receiving. Third-shift employees may start their shift helping with shipping, then switch to maintenance and clean up, and then switch to receiving.

Work culture

The predominant orientation is to 'get the job done', which mostly means timely, error-free order fulfillment. Given the nature of the shipment (many life-saving drugs and supplies that must be delivered on time), all energies are focused on 'getting the shipment out the door'. Second-shift workers typically cannot leave till the last major order is shipped, even if it means staying past midnight. The environment can also be described as a 'heads down', where each employee knows what needs to be done and does it.

While most tasks are individual, there is a natural incentive to collaborate and help each other, as you cannot leave without getting the job done. Workers are paid by the hour, so if one's task is finished, one looks for other tasks to do without overt prompting by the team leader. This is partly because employees want to assure themselves of a minimum and steady amount of income by working a set number of hours; and partly because all employee actions are tracked by the system. As described earlier, each time an item is handled, the system also records who performs the action. There is also peer pressure from coworkers, particularly the veterans. Employees wishing to earn more can come up to 2 hours earlier than the scheduled time of their shift and can stay as late as they wish. Excessive overtime is not encouraged, however.

Collaboration and cross training is encouraged. This is facilitated by the lack of formal job titles, job descriptions, and departmentalization. The system discourages 'not my job' syndrome. Workers are encouraged to take initiative and go to tasks. In the absence of defined job assignments, one cannot claim that a particular task is 'not my job'. Leaders regularly remind workers that if they spot a problem, 'they own it', meaning it is their responsibility to successfully resolve it by personally taking care of it or contacting the right people in person or on the phone. No sending a memo or e-mail and forgetting about it.

Overall, the atmosphere is relaxed. Sweet roles are passed out in the morning and there is a fresh fruit basket in the break area as well as free coffee and beverages. Subsidized gym membership is available for all employees. There is no dress code and no requirement to punch in by a certain time. President and most administrative staff leave at 5 pm. Customer service people usually stay till 6 pm when the telephone system is closed. Office personnel work late if needed, but people are discouraged from working excessive hours and, in general, there is no work on weekends, except for those who come in on Sunday night to start the next week. Tenure and loyalty are encouraged. Veteran employees get special privileges such as working the shift and job of their choice and being first in line for food at the Christmas dinner. Senior office employees can also briefly excuse themselves during the day to run personal errands. Management encourages a family atmosphere and will support employee recreational initiative like a fishing tournament. Many employees also meet socially outside work hours.

Alternative Management Methods

In most organizations with a turnover of $2 billion, an established HR department will be in charge of maintaining job descriptions and coordinating recruitment and selection based on those descriptions. Hiring will be for specific positions and specific skills will be sought. Managers will engage in planning, will have meetings for coordination and decision making, and will have formal performance evaluation meetings with their subordinates. At MD, none of these conditions hold true as described below.

Recruitment and selection

As there are no formal titles or job descriptions, employees are hired for their attitude, general aptitude for learning, and character. Being a workplace that handles controlled substances, all employees have to pass a polygraph test administered in house. In the warehouse, unskilled recruits are usually high-school graduates. Many of the older employees have military experience. There is a chronic shortage of staff as many applicants through traditional channels (e.g. print media advertising) do not pass the drug test. The company relies heavily on word of mouth and employee referrals, particularly of friends and acquaintances who have been laid off elsewhere due to business downturns. Employees may bring in their children or relatives for a summer internship and many stay on. As employees are hired into the organization and not to any particular job, they can be assigned to meet specific needs and reassigned as needed.

At the administrative or middle management levels, there is a philosophy of hiring ‘good people’ and finding a job that fits the person. In one extreme example, an experienced

individual who was laid off by his former employer was hired without a formal assignment or job position. As this individual familiarized himself with the operations he discovered a more efficient way to manage supplier relationships. He developed the system and is now responsible for that task.

The absence of job-based hiring gives the organization a lot of flexibility. Individuals can be moved in and out of roles without barriers and can gravitate toward activities that interest them. The emphasis is on attitude and willingness rather than specific roles. Except for junior unskilled workers, top management meets all recruits and personally conveys to them the values, work ethics, and expectations of the company.

No job descriptions and titles

The absence of job titles and descriptions is a deliberate policy to increase flexibility. Job descriptions and titles are considered limiting and ultimately a barrier to organizational effectiveness. Many job descriptions become obsolete quickly and often do not reflect accurately what employees actually do. The prevailing philosophy at MD is that people should be willing to work wherever the need arises. At all times, the goal of customer order fulfillment and satisfaction should be uppermost, and individuals should be prepared to 'get up and do something totally different if needed'. Supervisors can work the line if needed. As mentioned earlier, absence of job descriptions and titles facilitates movement of personnel on a daily basis. Though people on a given shift have a primary work area, they move around from task to task as needed. The overlapping shifts arrangement mentioned earlier is made efficient due to the flexibility provided by the absence of job descriptions and specific job titles for each person.

Absence of job titles also facilitates communication. Any one in any part of the organization can pick up the phone and contact anybody else without worrying about formal lines of communication and status in the hierarchy. The trainee in the accounting department can directly call the production manager and ask for a clarification regarding a customer order.

Not having job descriptions can also encourage initiative and innovative behavior. As the ultimate objective (customer order fulfillment) is clear and non-negotiable and there are no limits to what any individual can or cannot do, employees can take necessary action to resolve issues without the bureaucratic barriers in most organizations.

Aptitude based career progression

All new warehouse employees regardless of prior experience start out manually picking orders to understand the basic operation. They may then be moved to other areas based on aptitude and performance. For example, those prone to careless mistakes are not assigned to

tasks requiring accuracy like verifying orders. As employees perform a variety of tasks on a daily basis, the new hire has the opportunity to cross train and be multi-skilled fairly quickly. Those who show interest and initiative are entrusted with more and more responsibilities based on demonstrated competence. The absence of job descriptions and titles means that responsibilities can be added at any time and individuals can progress without having to wait one's turn for promotion. The absence of formal titles also means that individuals do not have formal authority over their coworkers. This in turn means that they have to earn the respect of their coworkers in order to be effective. Many do not wish to take on additional responsibilities and will eventually find a niche that they are most comfortable in.

There are no formal annual performance appraisals. Individuals receive ongoing feedback and are observed by team leaders and supervisors. An annual increase in pay signals formal organizational approval. As the system records most aspects of employee performance and yields objective measures (e.g. items handled, error rates) feedback is mostly accurate and data based. High-potential employees can be spotted by any team leader or supervisor, even someone from a different area or shift who has had an interaction with the employee. The employee is then tested with additional responsibilities, and depending on demonstrated competence, moves to a higher responsibility level.

No formal meetings

In a typical organization, many managers spend a lot of time in meetings. At MD, formal meetings are actively discouraged. Direct one on one communication is the norm. Without titles, no body has the authority to call meetings! There are no routine, start of the day or end of the day meetings or regularly scheduled meetings, except for top management who meet once a month. Top management may also call meetings with concerned individuals for special projects such as replacing an expensive piece of equipment. However, meetings may evolve informally around issues. One person may contact another regarding an issue and soon all people concerned may meet to resolve it. The production manager, supervisor, and team leaders may meet informally in the break room to discuss bottlenecks that may arise in the day's operations. As there are no scheduled meetings, one cannot wait for a proper forum to bring up issues. As a result, issues tend to get resolved right away. There is no need for formal performance-appraisal meetings as feedback is ongoing.

As can be seen above, the fundamental innovation is the deliberate absence of job titles, job descriptions, formal departmentalization, and defined hierarchical levels. This non-hierarchical, flexible arrangement allows lateral communication and ease of problem solving, discourages turf battles, and encourages creative contribution regardless of age or tenure. For example, a junior employee can participate in a major decision with more senior persons if he or she is considered a valuable resource. Responsibilities can be added at any

time and high potential employees can be fast tracked to positions of responsibility. In addition to the obvious flexibility in hiring and job assignments, it forces a tremendous amount of civility. You cannot order anybody to do anything – you have to request actions. It forces leaders to rely on earned respect rather than formal authority to get things done. It also encourages cooperation. Compliance with a current request might facilitate a reciprocal request in the future – I will listen to you today, as I might need something from you tomorrow.

Potential problems

Externally, the foremost problem seems to be that 'nobody understands'. Customers and suppliers alike are confused and turned off by the lack of titles, which they associate with authority and seniority. Large institutional customers expect negotiations to be conducted by someone in authority. Similarly vendors selling expensive, multi-million dollar equipment expect to deal with senior decision makers as commonly identified by a title. Faced with this reality, the company was forced to allow those dealing with customers and vendors to use titles when needed.

Internally, the unique culture makes it hard to recruit and integrate personnel at anything but the lowest level. Those with experience in the typical hierarchical organization often find it difficult to adjust to the 'lack of structure' and quit. Only those who are comfortable operating in this environment will stay. The lack of defined lines of authority can also lead to confusion and insubordination. For example, employees can refuse to comply with a team leader's request to switch tasks. The team leader has no authority to reprimand or otherwise discipline the employee. Often these and other such conflicts cannot be resolved except by top management and this is an inefficient method to resolve conflicts.

Transferability to other settings

There are a number of factors that allow this company to function in the unique manner that it does. First, being a tightly controlled family-owned company, it is easier to make and enforce decisions that support the philosophy. Second, top management is physically present on site to monitor operations at all times as needed. This limits the geographic expansion of the model. In fact, managers hired at the outlying locations soon recreated the traditional hierarchical model they were used to in other organizations. Third, the organization's task environment is simple and relatively stable. There are a limited number of variables to deal with and the tasks are fairly predictable from day to day. The high degree of automation further reduces variability. As the price to the customer is independently fixed and costs cannot be passed on to the customer, profit is a function of increased efficiency and reduced costs. Thus automation to the extent possible is a competitive necessity. Fourth, the standardization of the work process via automation and electronic tracking of employee efforts makes it easier to function without titles and descriptions. The lack of a union also helps.

The benefit from this case study of such a unique organization is akin to studying exceptions to better understand underlying principles. The fundamental innovation is the deliberate attempt to minimize artificial barriers to efficiency through avoiding defined job titles, job descriptions, and a hierarchical structure. The tremendous flexibility that accrues to organizations is worth attempting to emulate. As a first step, organizations can organize into smaller units such that each of those units can operate with minimal hierarchical levels. For example, Johnson and Johnson (180 units) as well as Asea Brown Boveri (5000 units) have made deliberate attempts to evolve into a collection of smaller units rather than a large, centralized operation. In all organizations, job descriptions can be broadened in scope or redefined in terms of processes and outcomes rather than tasks. Switching to horizontal team-based structures is another route to a non-hierarchical structure. The emphasis on getting the job done is a guiding principle that could potentially be applied to all organizations.

It should also be recognized, however, that delayering for its own sake could be counterproductive. Traditional career structures with their proven motivational value suffer and employees can become anxious and overwhelmed by the ambiguity and lack of role definition (Littler, Wiesner & Dunford 2003), and flatter is not always better. Organizations should primarily be seeking ways to increase flexibility rather than be wedded to a particular form or prescription such as 'no job titles or description'. One should keep in mind, regardless of the philosophy and structure adopted, the work still has to be carried out by human beings with individual needs and aspirations, who will make their own individual and collective adaptations to the organizational environment.

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ORGANIZATIONAL SURVEY RESPONSE: PREVIOUS FINDINGS AND AN INTEGRATIVE FRAMEWORK

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Abstract: *This chapter discusses nonresponse to organizational surveys focusing on methodological and theoretical issues related to nonresponse. The first section provides an overview of methodologies for the study of nonresponse, including archival databases, the wave approach, the follow-up approach, and population profiling, as well as a discussion of methodological challenges in nonresponse research. The second section summarizes previous nonresponse research by examining demographics, attitudes, and organizational and survey characteristics as antecedents of nonresponse. The third section provides an integrated framework for the study of survey response. Building on previous research, we develop a model that posits several mechanisms that explain why nonresponse occurs. This model incorporates multiple levels of analysis and acknowledges the role of individual differences and situational characteristics on nonresponse behavior. In addition, we also discuss the future of nonresponse research by exploring the role of narrow personality traits, advances in technology, and organizational and national culture in survey nonresponse.*

A large percentage of social science research findings are based on survey research. For researchers in organizational behavior and for Industrial and Organizational (I/O) psychologists, surveys are the primary method of data collection. Considering the prevalence of survey research in the social sciences and particularly in I/O psychology, researchers and practitioners have continued to voice concerns about response rates (Baruch 1999; Roth & BeVier 1998): Of particular concern is the effect of nonresponse on the validity of survey-based research findings. For example, if an average of 30-50% (and in some instances more) of those initially contacted to respond to surveys fail to comply with the request for survey completion, are survey research findings really generalizable to the overall population or should we be talking, at best, about those who chose to participate in organizational surveys? Similarly, one may wonder what leads some individuals to respond to organizational surveys while others fail to comply with the request for survey completion.

Over the past decade, progress in nonresponse research has been substantial, but nonresponse research as a field still lacks an in-depth understanding of many of the processes and mechanisms that lead some individuals to complete and return surveys, while others fail to comply to do so. Similarly, methodologies used for the study of individuals who are usually not inclined to participate in surveys need to be further developed.

The objective of this chapter is to provide an overview of previous research on survey nonresponse in organizational surveys[1], with an emphasis on unit nonresponse in organizational and employee surveys. Based on previous research, we discuss methodological techniques used to study nonresponse, summarize nonresponse research findings, and provide a conceptual framework that may lead to further advances in what we know about survey response behavior and unit nonresponse. Although many of the findings discussed in this chapter are likely to translate to other social sciences, findings that specifically pertain to the relationship between employee and employer may not be as likely to transfer to disciplines other than organizational behavior and Industrial and Organizational psychology.

Nonresponse behavior can take various forms and range from incomplete item response to unit nonresponse where individuals never return their questionnaires (Groves, Dillman, Eltinge & Little 2002). Although generally treated as two separate phenomena, item and unit nonresponse are likely to have similar antecedents, and some researchers have indeed suggested that item nonresponse may constitute a 'milder form' of survey nonresponse. For instance, individuals with extremely low levels of trust in the survey-sponsoring entity may decide to not respond to the survey at all, whereas individuals who trust the organization somewhat may choose to not complete items that may be used to identify them (Spitzmueller, Borg, Sady, Barr & Spitzmueller 2006). Though we do recognize the similarities between item and unit nonresponse behavior, we focus our discussions in this chapter on unit nonresponse in organizational surveys.

In summarizing previous accomplishments of nonresponse research and identifying future directions, we first discuss methodologies for the study of survey nonresponse, and discuss challenges previous nonresponse research has encountered, as well as opportunities for further development of methodologies for the study of nonresponse. Second, we discuss previous research findings and theoretical models for the study of unit nonresponse

1 Respondents and nonrespondents to organizational and employee surveys differ in their relationships with the sponsoring organization from individuals who complete public opinion research surveys, and marketing surveys. In particular, employment relationships are usually longer-term and more strongly based on reciprocity than relationships between public opinion or market research firms and their study participants.

in organizational surveys (e.g. Bosnjak, Tuten & Wittmann 2005; Rogelberg, Luong, Sederburg & Cristol 2000), and summarize what we know about the role of individuals' demographics, attitudes, personality, social exchange relationships, organizational experiences, and culture with survey response behavior. Based on our discussions of previous nonresponse research, we extend previously developed frameworks, and propose an integrated theoretical model for the study of employee survey response behavior, integrating variables that have previously received little attention in survey response research.

Methodologies for the study of survey nonresponse

Nonrespondents are elusive by nature – as they fail to participate in surveys we generally have relatively little information available about their characteristics, motivation, and their relationship with the sponsoring organization. As a result, nonresponse research has been plagued by methodological challenges pertaining to the assessment of characteristics of nonrespondents (Beatty & Herrmann 2002; Rogelberg et al. 2003; Rogelberg, Luong, Sederburg & Cristol 2000). Still, numerous methodological approaches have been suggested, and their shortcomings and strengths have been discussed (Rogelberg et al. 2003). Rogelberg et al. have previously briefly summarized methodologies for studying nonrespondents (Rogelberg et al. 2003). In this section, we supplement information contained in their review, and further discuss strengths and challenges associated with the different methodologies.

Archival Databases. Early nonresponse research used archival databases that predominantly contained information about demographic characteristics (Gannon, Northern & Carroll 1971). Using this archival approach, surveys were sent out to individuals whose information was stored in the database. Generally, the survey contained a label or other piece of identifying information that allowed researchers to compare respondents and nonrespondents on variables contained in the archival dataset after the questionnaires were returned. Unfortunately, the archival approach was limited in that respondents and nonrespondents could only be compared on characteristics contained in the original database. Thus, comprehensive comparisons of respondents and nonrespondents have rarely been possible in nonresponse studies utilizing archival databases.

Today, organizational databases are frequently built based on systems such as those by SAP or PeopleSoft and contain a wealth of information. For instance, many organizations store records about job performance, absenteeism, promotions, as well as information collected during personnel selection procedures in their HR databases (Stanton & Weiss 2003; Stone, Stone-Romero & Lukaszewski 2006). Thus, while analyses of archival data used to be limited to demographic variables, today's databases could allow for more substantive

analyses of differences between respondents and nonrespondents. For example, future research could investigate potential differences in employee performance, promotion, and attrition between respondents and nonrespondents. However, the use of organizational databases requires linkage of database information to organizational survey data, which prevents surveys from being administered anonymously. As a result, the use of archival databases for nonresponse research is likely to be challenged by union representatives and employees as it eliminates the anonymity of survey responses.

For nonresponse researchers, application of the archival approach in using today's HR database systems may be a viable option if appropriate precautions are taken to reduce employee concerns about the lack of anonymity. For example, if researchers can ensure that linkage information used to combine database information with information about response behavior is only available to an independent research team, but not to organizational representatives, and if employees understand that their employer will not have access to information linking their responses to archival or other identifying information, researchers may be able to effectively use the archival approach without compromising employee concerns about confidentiality of employee survey results. These recommendations are in line with Stanton and Weiss's (2003) observation that organizational data can be used if trust and adequate justification of policies pertaining to information use are taken into account.

Wave approach. Wave approaches use failure to meet a survey deadline as a proxy for nonresponse. This approach classifies responses received before an initially defined deadline as responses, and those received after the deadline as nonresponse (which they technically are or would be if the deadline was strictly enforced and if late responses were excluded from analyses). Using wave approach methods, comparisons between early and late respondents are then conducted. Critiques of the wave approach have noted that in fact late respondents are still respondents, who may be less likely to differ from those who never respond than from those who did respond in a timely fashion. As a result, research using wave approaches has been very limited in scope, and differences between early and late respondents were generally found not to be substantial.

Follow up approach. Follow-up approaches (e.g. Sosdian & Sharp 1980) utilize contact information obtained for individuals who did not respond to an initial survey. These individuals are then contacted by the research team and asked why they failed to comply with the request for survey completion. Among the reasons frequently cited by nonrespondents who are interviewed are: lack of time, never received questionnaire or questionnaire got lost. Although follow-up approaches provide some insight into nonrespondents' rationales, they are likely to be limited in terms of the information that can be

obtained. For instance, nonrespondents are unlikely to tell a member of the initial survey research team that they thought the survey topic was boring, or that they disagreed with the general premises of the survey. In other words, socially desirable responses appear rather likely to occur in personal follow-up interviews.

Population profiling. More recently, population profiling approaches (Rogelberg et al. 2003) have shown promise for the more fine-grained study of survey response behavior because they allow researchers to distinguish between different groups of nonrespondents. In using population profiling as a research method and approach, researchers gain access to a setting where completing a survey is mandatory. As a result, access to a near 100% response rate can be ascertained (e.g. training class setting). In a first step, individuals complete an initial survey that assesses constructs related to nonresponse and provide contact information, such as an email or postal address. Several weeks later they then receive an invitation to participate in a seemingly unrelated survey. Response or nonresponse to the follow-up survey is then related to variables contained in the initial dataset, allowing for a detailed comparison of respondents and nonrespondents on numerous variables. Recent studies (Rogelberg, Little & Spitzmueller 2005; Spitzmueller, Glenn, Barr, Rogelberg & Daniel 2006) have successfully used population profiling and gained access to new and relevant information about nonrespondents.

Population profiling approaches have also been combined with intentions methodologies (Rogelberg, Luong, Sederburg & Cristol 2000). Intentions methodologies ask individuals in a cross-sectional survey whether they intend to complete a future survey within a given time frame if they are asked to do so. Usually, rating scales that range from 'definitely will not participate' to 'definitely will participate' are applied, and individuals with and without intentions to complete surveys are compared. In combining intentions methodologies with population profiling methods, researchers have found that – although large numbers of individuals indicate they intend to complete future surveys – only about 10-15% state they would not complete future surveys. In contrast, actual survey response in population profiling studies lags behind individuals' intentions to respond: The majority of individuals who report intentions to complete future surveys never follow up when they are actually asked to complete a survey. As a result, Rogelberg et al. (2003) classified nonrespondents into two groups: active nonrespondents and passive nonrespondents. Active nonrespondents are individuals who do not intend to respond, and behave consistently when asked to respond. Passive nonrespondents, in contrast, are those who initially reported intentions to complete future surveys, but who fail to actually follow up when they are approached with a request for survey completion. Passive nonrespondents generally make up the largest group of nonrespondents, and are reported to make up about 70% of the overall population initially surveyed in previous population profiling studies.

Most recently, Rogelberg et al. (2005) have further combined population profiling, intentions, and follow-up approaches to gain a more holistic picture of nonrespondents and their characteristics. They conducted population profiling studies, collected information about intentions to respond on the initial survey, and followed up by email with all nonrespondents (both active and passive), asking them why they did not complete the follow-up survey. Results of these studies generally support that passive and active nonrespondents do not complete surveys for different reasons: disinterest in the particular topic and perceived irrelevance of the topic (Rogelberg, Little & Spitzmueller 2005) appear to play a role for passive nonrespondents. Active nonrespondents, in contrast (if they respond to the follow-up email at all) express hostility and anger with the survey sponsor, which is consistent with the finding that active nonrespondents experience less social exchange with their organization and have lower perceptions of organizational fairness and support than do passive nonrespondents (Spitzmueller, Glenn, Barr, Rogelberg & Daniel 2006).

Methodological challenges in nonresponse research

Nonresponse research methodology has been plagued by challenges, with the difficulty of gaining access to nonrespondents, who generally fail to comply with requests for survey completion, only being one of them. Other challenges involve attempts to conduct ethically responsible research that is based on participants' voluntary survey completion and informed consent. In most cases, efforts to make survey participation in nonresponse studies completely voluntary leads to low response rates, and results in access to no or very low numbers of individuals who are usually passive nonrespondents, and virtually no access to active nonrespondents.

Efforts to capture the response behavior of actual employees should receive particular attention – over the past years, research on organizational survey response has focused on examining students (Rogelberg et al. 2003; Spitzmueller, Glenn, Barr, Rogelberg & Daniel 2006). Although students are stakeholders in their organization who form attitudes towards their organization (Mael & Tetrick 1992), their relationships with their university may involve lower levels of perceived obligation towards the survey sponsor than surveys conducted in situations that involve the social exchange relationships typical for employers and their employees.

Statistical power and access to sufficiently large numbers of active nonrespondents and respondents pose further challenges – if only 10%-15% of an initial population are active nonrespondents, it is imperative for researchers interested in comparing them to passive nonrespondents and respondents to gain access to rather large populations in the initial population profiling dataset. Moreover, if the objective is to examine moderated relation-

ships as predictors of response behavior or the processes that explain nonresponse, the required sample sizes for initial profiling stages are likely to have to be quite large. Attaining these initial population profiling datasets can be particularly challenging if survey administration has to occur in closed settings, such as classrooms, training or employee induction programs, which in most cases are unlikely to contain populations of 500 or even more (which may be necessary depending on anticipated effect sizes, number of respondents versus nonrespondents in the particular dataset, and the analytical techniques chosen for statistical analysis). Moreover, there are ethical considerations regarding the voluntary nature of survey participation as well as concerns regarding the quality of data obtained from a closed administration setting. Keeping in mind the various methodological challenges mentioned earlier, we now turn to a discussion of results of previous research on survey response behavior and nonresponse in organizational surveys, as well as our discussion of variables that would be fruitful to examine as antecedents of nonresponse in future research.

Demographics, attitudes, organizational experiences, survey characteristics, and personality antecedents of response behavior

Organizational survey respondents and nonrespondents have been frequently compared on demographic variables. Generally, research supports that women, older employees, Caucasians, and individuals with higher education levels are more likely to respond than males, younger workers, members of minority groups, and those less educated (Gannon, Northern & Carroll 1971; Rogelberg, Luong, Sederburg & Cristol 2000). Interestingly, research on demographic differences between respondents and nonrespondents has rarely examined variables that may explain why demographic characteristics are predictive of survey response behavior. Although research in organizational behavior and applied psychology, as well as social psychology, has suggested the inclusion of psychological variables that may underlie demographic differences, these suggestions have not yet been implemented or examined in survey response behavior research. For instance, gender roles, such as masculinity and femininity (Goktepe & Schneier 1989; Kirchmeyer 2002), may explain more closely why more men than women fail to comply with requests for survey completion.

Recent nonresponse research has paid particular attention to individuals' organizational experiences with the survey sponsoring organization (Bosnjak, Tuten & Wittmann 2005; Rogelberg, Little & Spitzmueller 2005; Spitzmueller, Glenn, Barr, Rogelberg & Daniel 2006). Respondents as well as passive nonrespondents appear to perceive their social exchange relationships with their employers as more balanced, further, they are more likely to perceive organizational support and procedural justice as high, and psychological contract violations as low.

Exchange relationships may not only contribute to explaining differences in job and organizational attitudes of nonrespondents, but may also function as antecedents of employees' job attitudes. Past nonresponse research has found that, overall, respondents and passive nonrespondents appear to be similar in terms of satisfaction with their organization, affective and normative, as well as continuance commitment and intentions to stay with their organization (Rogelberg et al. 2003; Rogelberg, Luong, Sederburg & Cristol 2000). Similarly, previous research that compared active and passive nonrespondents' organizational attitudes found that respondents and passive nonrespondents share more positive organizational attitudes that are in contrast to the attitudes of active nonrespondents, which usually tend to be less positive.

Still there is much to learn about attitudes and social exchange as antecedents to survey response behavior. Notably, attitudes that have been studied have focused on the most commonly studied job attitudes (e.g. satisfaction and commitment), with less attention being devoted to other relevant job attitudes such as organizational identification (Mael & Ashforth 1992) and job involvement (Reeve & Smith 2000). The role of personality predictors in survey response behavior has also been debated for extended periods of time. Before the emergence of the Big Five framework, respondents and nonrespondents were compared on numerous trait attributes (Gough & Hall 1977). Although results were somewhat conflicting and difficult to integrate due to the use of numerous narrow personality traits, it appeared that respondents tended to be more gregarious, conscientious, and more disposed to adhere to social norms than nonrespondents. After the emergence of the Big Five framework (McCrae & Costa 1987), numerous studies have examined whether openness to new experience, conscientiousness, extraversion, agreeableness, and emotional stability contributed to survey response behavior. Conscientiousness appears to distinguish between respondents and passive nonrespondents, and Bosnjak, Tuten & Wittmann (2005) have identified additional differences on Big Five traits (e.g. openness to new experience) that may function as antecedents to survey response behavior.

Based on personality research's debate about the role of narrow versus broad traits in predicting behavior, response behavior research on social exchange has started integrating specific personality traits that pertain to individuals' propensity to view exchange relationships in different lights. For instance, reciprocation wariness has been found to be lower among active nonrespondents than among passive nonrespondents and respondents (Spitzmueller, Glenn, Barr, Rogelberg & Daniel 2006). As a result, the examination of other exchange-oriented personality traits may lead to a more thorough understanding of the specific dispositional characteristics that relate to response behavior. Research efforts geared in this direction are likely to find support as specific, narrow personality traits appear to be more likely to predict specific behaviors in a certain domain than broad overall patterns of behavior, where broad traits like the Big Five are more likely to matter (Ones & Viswesvaran 1996).

Integrated framework for the study of survey response behavior

In the following sections, we discuss our theoretical framework for the study of survey response behavior. Based on previously developed theories for survey response behavior (Bosnjak, Tuten & Wittmann 2005; Dillman 2000; Rogelberg et al. 2003; Rogelberg, Luong, Sederburg & Cristol 2000) we propose an integrated framework for survey response behavior based on Rogelberg et al.'s (2000) model. The framework consists of individual differences, perceptions of survey characteristics, facilitating and inhibiting factors, and response intentions. We recognize that intentions are likely to partially mediate the relationship between individual difference characteristics and response behavior (Ajzen 1991; Bosnjak, Tuten & Wittmann 2005; Fishbein & Ajzen 1975). Thus, discussions of survey response behavior as an outcome variable assume intentions to respond function as a partial mediator in our model. In the following sections, we discuss the role of individual differences, perceptions of survey characteristics, facilitating and inhibiting situational factors, and intentions to complete surveys in actual compliance with requests for survey completion. In introducing the proposed extension of Rogelberg's (2000) framework, we also propose several moderator effects that may explain why some main effect findings that were detected in previous research (e.g. role of Big Five personality traits) have been inconsistent across studies.

Demographic variables and survey response behavior – proposed mediators

Previous nonresponse research has identified age, gender, education level, and ethnicity as precursors of survey response behavior. Namely, older individuals, females, those with higher levels of education, and Caucasians have been found to be more likely to complete surveys. Still, we know very little about the psychological and situational variables that lead members of some demographic groups to respond to organizational surveys. In other words, research about demographic antecedents of nonresponse has been rather descriptive. Social psychologists have argued for long that examining demographic variables such as gender as a predictor may be interesting, but may ultimately fail to explain why demographic differences do occur, or what psychological mechanisms account for the differences between men and women and other demographic groups (e.g. differences between ethnic groups).

As part of our framework, we proposed that the relationships between demographic variables and survey response behavior may be mediated by social exchange variables, and by reciprocity-oriented personality variables. Previous nonresponse research has identified procedural justice, perceived organizational support, and the personality variable of reciprocation wariness as precursors to survey response (Spitzmueller, Glenn, Barr, Rogelberg &

Daniel 2006). We propose that differences in perceptions of social exchange variables and personality variables pertaining to exchange, such as reciprocation wariness and equity sensitivity are likely to mediate the relationship between demographics and organizational survey response behavior. Specifically, older individuals, the more educated, and Caucasians may perceive having received more benefits and support from their organization than younger employees, those with lower education levels, and non-Whites.

Possibly, relationships between gender and survey response behavior may be explained by examining reciprocation wariness as a potential mediator. Reciprocation wariness is defined as an individuals' general tendency to feel exploited in social relationships, or to contribute more than one receives back (Eisenberger, Armeli, Rexwinkel, Lynch & Rhoades 2001; Eisenberger, Cotterell & Marvel 1987). Females may be more likely to be low on reciprocation wariness than males, expecting lower levels of pay-off for contributions (Newson 2002), and possibly perceiving what they are getting back from their organization for their efforts as more commensurate with their input. As a result, females may view participation in an organizational survey more as an opportunity to reciprocate than as the organization's efforts to exploit employees and take more from the exchange relationship between employee and employer than adequate.

Future research on demographic differences as antecedents of nonresponse should also examine which psychological variables may explain why females are generally more likely to respond to surveys than males. Recent research on gender differences has proposed that a gender schema, or one's mental framework for the processing of gender-specific information (Eddleston, Veiga & Powell 2006; Goktepe & Schneier 1989) may explain why males and females differ in various dimensions of organizational behavior, such as valued career outcomes. Similarly, one's gender schema may be responsible for helping one's organization through survey completion. For instance, female gender schemata are likely to be aligned with altruism towards the organization and those who request survey completion, while male gender schemata may lead individuals to not view survey completion as an action consistent with one's gender schema. In other words, helping behaviors may not be as central to male gender schemata as to those of females.

Previous organizational experiences and survey response behavior

Rogelberg et al. (2006) proposed the integration of organizational experiences into models of survey response behavior. Previous experiences with surveys, and survey-based organizational development interventions may influence the benefits employees view in complying with a request to complete an organizational survey. If employees are under the impression that neither follow-up activities nor organizational changes resulted from

previous organizational survey efforts, employees may be less likely to be willing to contribute their opinion again if they feel their previous survey completion made no difference. Thus, we propose that organizational cynicism (Johnson & O'Leary-Kelly 2003; Newson 2002) should be examined as a potential antecedent to survey response behavior that captures an individual's perception of whether the organization has adequately dealt with data previously collected, or whether employees feel that 'no matter what, nothing will change'. More distal variables, such as an organization's way of dealing with employee suggestions for improving processes, may also impact organizational survey response behavior. Consistent with previous research on social exchange models as antecedents of survey response (Dillman 2000; Dillman, Eltinge, Groves & Little 2002; Spitzmueller, Glenn, Barr, Rogelberg & Daniel 2006), we argue that if organizational stakeholders experience that their voices are generally heard and their opinions are taken seriously, they may be more likely to contribute further by participating in employee surveys.

Organizational reward system's sensitivity to organizational citizenship behavior may also play a role in employees' likelihood to complete organizational surveys. Schnake & Dumler (1997) identified organizational reward systems as predictive of employees' reported engagement in organizational citizenship behavior. As past research on survey response behavior has argued that survey response behavior is closely linked to organizational citizenship behavior, organizations where reward systems are in place that encourage citizenship behavior and/or interpersonal helping behavior may benefit in terms of higher response rates in organizational surveys.

High levels of trust in management that were established over time may also influence response behavior in that individuals who perceive their managers as trustworthy may have fewer concerns about organizational survey data being misused or used to identify those with negative attitudes. In other words, individuals who trust management at their organization may perceive survey anonymity as more favorable than individuals who distrust their management. Perceptions of survey anonymity may thus mediate the relationship between trust in management and response behavior.

Personality and survey response behavior

Research on the influence of personality on survey response behavior has lead to mixed findings, and somewhat inconsistent results (Rogelberg & Luong 1998). Initial examinations compared respondents and nonrespondents on traits such as gregariousness (Ognibene 1970), intellectualism (Vincent 1964), with results being difficult to compare due to the various personality frameworks that were applied. After the Big Five framework unified personality research (McCrae & Costa 1987, 1999), nonresponse research has utilized Big

Five traits to examine response behaviors (Marcus & Schutz 2005; Rogelberg et al. 2003; Rogelberg & Luong 1998). Some researchers have found that active nonrespondents are likely to be lower on both conscientiousness and agreeableness than passive nonrespondents and respondents, with passive nonrespondents also being somewhat lower on conscientiousness than respondents (Rogelberg et al. 2003). Others have identified extraversion, and openness to new experiences as supplementary predictors of survey response behavior (Marcus & Schutz 2005). Notably, findings relating the Big Five traits to nonresponse are somewhat conflicting in that results pertaining to conscientiousness, extraversion, agreeableness and openness to new experience have not been consistently found across studies. As survey response behavior is a rather specific behavior, one reason for the inconsistent findings across studies may stem from the fact that broad personality traits may not be as predictive of specific behaviors in a given domain as narrower personality traits that are facets of the Big Five or other models (Ones & Viswesvaran 1996). Recent research supports the notion that reciprocation wariness, or an individuals' disposition to feel exploited in social relationships, is likely to relate more strongly to survey response behavior than the Big Five personality traits (Spitzmueller, Glenn, Barr, Rogelberg & Daniel 2006). Thus, an examination of the role of other narrower personality traits in survey response behavior may prove beneficial. For instance, equity sensitivity, an individual difference variable that pertains to individuals' preferences pertaining to equity and inequity (Huseman, Hatfield & Miles 1987), another exchange-oriented personality variable, may impact survey response behavior. Benevolent individuals who deem high input on their part acceptable despite possibly somewhat low output on the organization's part are likely to be more comfortable completing a survey at the request of an organization than those who are equity sensitive (prefer equal input and output) or who feel entitled (prefer receiving more output than providing input).

Previous nonresponse research has also not yet responded to calls to integrate affective personality variables more strongly into organizational behavior research (Brief 2001). Trait positive affect, or the predisposition to experience positive affective states frequently (Lyubomirsky, King & Diener 2005; Watson, Clark & Tellegen 1988), may also relate to survey response behavior. Research on correlates of life success and happiness has found that positive affect relates to high level of energy and intense participation and engagement in life activities (Lyubomirsky, King & Diener 2005). As survey completion requires taking action, participating and taking an extra, active step to complete a survey, trait positive affect may influence response behavior, and may distinguish between those who intend to complete surveys in contrast to those who fail to comply with requests for survey completion.

Individuals' dispositional tendencies to engage in impression management and other socially desirable behaviors may affect survey response behavior, particularly in circumstances where anonymity of survey response is not a given. Those interested in impressing others and/or behaving in a socially desirable manner may be more likely to complete surveys than others who are less inclined to be agreeable, help others and their organization, and make a favorable impression.

Culture and survey response behavior

Organizational surveys used to be predominantly administered in one language and one country. Within the globalization of the workforce over the last decades, the practice of organizational survey administration has moved to many organizational surveys being conducted across cultures and in various different languages (Liu, Borg & Spector 2004). As a result, survey instructions and mechanisms that have been identified as influential in survey response behavior may be altered through the influence of culture (Johnson, O'Rourke, Burris & Owens 2002). For use in survey response research, culture has been defined as "a shared language and set of norms, values, beliefs, expectations and life experience" (Johnson et. al. 2002: 55).

In discussing the role of survey response in culture, Johnson et al. argue that cultural dimensions such as power distance and individualism and collectivism (Johnson, O'Rourke, Burris & Owens 2002) may influence response behavior. They propose that power distance (in cultures high on power distance, social equality is not emphasized, and some individuals possess much higher degrees of power than others) may impact survey response behavior. They predict that in high power distance cultures, if requests for survey completion originate from individuals with high power, employees may feel more pressured to respond than in low power distance cultures. Extending Johnson et al.'s predictions by integrating Rogelberg et al.'s (2003) framework for distinguishing different groups of nonrespondents, we hypothesize that in high power distance cultures where requests for survey completion come from an individual with high position power, there are likely to be fewer passive nonrespondents than in low power distance cultures. In particular, we suggest that passive nonrespondents in high power distance cultures feel more committed to engaging in activities recommended by those in power than individuals in low power distance cultures.

The cultural dimension of individualism/collectivism pertains to the value attributed to group versus individual interests (Johnson, O'Rourke, Burris & Owens 2002). In cultures where group interests are emphasized, requests for survey completion from members of the same group may be more impactful than those of individuals outside the reference

group. In contrast, in highly individualistic societies, it may play less of a role whether the individual requesting the survey completion comes from within or outside one's group or environment. Again, we anticipate that for passive nonrespondents in highly collectivist cultures, a request from within the collective or group will impact whether an individual feels compelled to respond, or whether they feel they can act upon other attitudes and time constraints in deciding whether to respond or not respond to an organizational survey. In contrast, the appeal for help from a group member is less likely to affect one's decision to respond to a survey than individual attitudes and personal gain in an individualist culture. These predictions about the influence of culturally-contingent levels of individualism are consistent with findings on utilitarian individualism in panel surveys, which has been found to predict survey response behavior (Loosveldt & Carton 2002).

Attitudinal predictors of survey response behavior

Satisfaction with the survey sponsor, continuance, normative and affective commitment have all been examined as predictors of survey response behavior (Rogelberg et al. 2003; Rogelberg, Luong, Sederburg & Cristol 2000). Although initial research identified few and inconsistent differences between respondents' and nonrespondents' attitudes, recent research that utilized the more fine-grained distinction between passive and active nonrespondents has provided an explanation for some of the conflicting earlier findings. Respondents and passive nonrespondents appear to have similar attitudes towards their organization. In contrast, active nonrespondents generally report more dissatisfaction and less affective and normative commitment (Rogelberg et al. 2003).

Altogether, examinations of job attitudes as predictors of survey response behavior have been rather limited. Among the studies that have examined potential respondent's attitudes as predictors of survey response, methodological and external validity challenges are prevalent. The studies that have used actual employees to investigate attitudes as predictors of survey response have used intentions to complete surveys as a proxy for actual survey completion behavior (Rogelberg, Luong, Sederburg & Cristol 2000). Although intentions are powerful proximal predictors of actual behavior, they remain proxies for actual survey response. Other studies gained access to actual survey response behaviors, but failed to gain access to employee samples. Instead, students' satisfaction and commitment towards their university were assessed. Admittedly, students' relationships with their university may be somewhat comparable with the relationships between employees and their organization. Still, more detailed investigations of the role of job attitudes in response behavior is needed in actual employee samples.

Previously studied job attitude predictors of survey response have focused on traditional organizational attitudes, such as satisfaction and organizational commitment. Other rele-

vant job attitudes, such as job involvement and organization identification, may also influence survey response behavior. Job involvement, or the extent to which an individual views their job as being a part of their self-concept and identity (Kanungo 1982; Lodahl & Kejnar 1965; Reeve & Smith 2000) may lead employees to view completion of work-related requests as essential to maintaining a positive self-image. Thus, individuals high on job involvement may be more likely to complete organizational surveys than individuals low on job involvement. Organization identification, or an employee's perception of sharing the values and characteristics of their organization (Mael & Ashforth 1992; Mael & Tetrick 1992), may also impact survey response. Employees high on organizational identification may view requests to complete organizational surveys as related to the organization's goals, and thus their own goals and values, which are consistent with the organization's. In line with previous research findings on attitudinal differences between respondents and nonrespondents, we expect active nonrespondents to differ from both passive nonrespondents and respondents in job involvement and organizational identification.

Attitudes towards surveys and perceptions of anonymity

Previous research has identified individuals' attitudes towards surveys as being influential in determining quality of responses, item level responses, and enjoyment in survey completion (Rogelberg, Fisher, Maynard, Hakel & Horvath 2001). As item nonresponse and unit nonresponse have been proposed to lie on a nonresponse continuum (Groves, Dillman, Eltinge & Little 2002), survey attitudes may not only affect item response and related behaviors, but also unit nonresponse in organizational surveys.

Nonresponse research outside the domain of organizational survey nonresponse has also identified perceptions of survey anonymity as relevant for response behavior and survey response rates (Bjarnason & Adalbjarnardottir 2000; O'Malley, Johnston, Bachman & Schulenberg 2000). Comparisons of confidential and anonymous surveys examining sensitive issues (e.g. drug and alcohol usage behavior, depression) have found higher levels of missing data in confidential than in anonymous surveys, suggesting that granting participants full anonymity may be beneficial in obtaining high-quality data with minimal intentional distortion of responses. In surveys assessing drug and alcohol usage, confidential survey response was also associated with higher nonresponse than in anonymous survey completion conditions. Thus, organizational surveys that assess potentially sensitive information (e.g. perceptions of managers and supervisors) should utilize anonymity in order to improve survey response behavior. Again, we anticipate that assurances of anonymity may impact the response behavior of passive nonrespondents, but not that of active nonrespondents whose decision not to respond is based on their more negative attitudes towards their organization (Rogelberg et al. 2003; Spitzmüller et al. 2006)

Perceptions of survey characteristics and survey response behavior

Survey characteristics, such as information provided about a survey's sponsor, topic domain of the survey and survey formatting, as well as survey length, may also impact survey response behavior. Public opinion research has shown that survey topic is a salient and relevant determinant of response behavior (Groves, Presser & Dipko 2004). Specifically, individuals' interest in a survey's topic has been found to relate to increased likelihood of survey response, potentially contributing to biases that may be of concern for organizational survey research as well as those examining response behavior in public opinion research. In research on organizational survey nonresponse, the content of organizational surveys has received relatively little attention in previous empirical studies, although findings from public opinion research may well translate.

Organizational surveys (both those that are administered via the internet or those that use paper-and-pencil methods) vary substantially in terms of formatting used, and in terms of the way survey cover letters as well as consent forms are structured to entice potential respondents to complete surveys. Again, public opinion and marketing research can inform research on organizational survey response behavior about the role of cover letter content, formatting of individual (web) pages, and other formatting decisions (Blair & Zinkhan 2006). Similarly, relatively little attention has been paid to the role of survey sponsors on response behavior. For instance, one may wonder whether requests for survey completion from an independent research institute or a university research lab lead a different set of individuals to respond than requests originating from an employer. Variables that may play a role in whether researchers' requests are more or less likely to be answered than organization's requests include information about data usage that is provided in the survey cover letter or cover email. For individuals who generally value education and knowledge, researchers' purposes in conducting surveys may be as persuasive as organizations' purpose to use survey data as a basis for organizational development interventions. In contrast, for individuals who see little benefit in independent researchers generating knowledge, an organization's request tied to an OD intervention may appear more practical.

Recently, more attention has been paid to the potential differences between web-based and paper-based surveys, as well as their respective influence on response behavior (Bosnjak, Tuten & Wittmann 2005). Previous findings in other fields that examined response rates for web-based versus paper-based surveys appear inconsistent, with sport psychologists (Lonsdale, Hodge & Rose 2006) and evaluation researchers (Kiernan, Kiernan, Oyler & Gilles 2005) reporting higher response rates for online surveys than for paper-based surveys, while researchers surveying physicians obtained lower response rates to web-based than to paper-based surveys (Leece 2004). Methods known to enhance response rates in

paper-based surveys, such as the personalization of cover letters, were not found to be fully effective for web-based surveys (Porter & Whitcomb 2003), leading some to the conclusion that relationships between predictors of survey response behavior need to be re-examined if response to web-based surveys is the outcome variable.

Several factors have recently been proposed that may impact web survey response, but not response to a paper survey (Rogelberg, Little & Spitzmueller 2005). Generally, it appears that variables impacting internet adoption and usage behavior may also be influential in determining web-based survey response behavior. Management Information Systems researchers have, over the past decades, refined models predicting technology adoption that have been successfully applied to internet usage and adoption of web-based systems, such as online credit card usage and shopping (Davis & Venkatesh 1996; Pavlou & Gefen 2004; Venkatesh 2000; Venkatesh, Morris, Davis & Davis 2003). Performance expectancy, or the "degree to which an individual believes that using the system will help him or her to attain gains" (Venkatesh, Morris, Davis & Davis 2003: 447), effort expectancy or the "degree of ease associated with the use of the system" (Venkatesh, Morris, Davis & Davis 2003: 450) and variables pertaining to the degree of control an individual perceives over computers and the internet as a medium, such as computer self-efficacy are likely to influence comfort and likelihood of using the internet. This model suggests that individuals who are hesitant to use the internet, may also not respond to web-based surveys.

Situational constraints, facilitating conditions, and survey response behavior

Numerous factors may facilitate survey completion, while others may reduce the likelihood of an individual actually completing a survey. In his 2000 model for survey response behavior, Rogelberg et al. introduced several situational factors that may constrain survey response behavior. These situational constraints decrease the likelihood of an individual completing a survey, and include factors such as: time availability, proximity to a survey drop station, and the availability of high-speed internet access for web-survey response. In contrast, other situational factors, such as a raffle, gift, cash or other incentives for participation, may facilitate survey response in that they may increase the likelihood of an individual responding to organizational surveys. Notably, few studies have examined the role of situational constraints on response behavior, with incentives being among the more frequently investigated predictors of response (Church 1993; James & Bolstein 1992).

Job characteristics introduced in the job stress literature may also function as an additional situational constraint on individuals' likelihood to respond to organizational surveys. For instance, recent research (Barr et al. 2006) found job ambiguity to be predictive of survey response behavior. Individuals were more likely to complete organizational surveys if

they experienced high levels of role ambiguity than if they experienced little or no role ambiguity. This points to the possibility that employees who are uncertain about their job responsibilities and experience role ambiguity (House & Rizzo 1972) may in fact view completion of an organizational survey as part of their job responsibilities, while others who experience lower levels of role ambiguity may feel certain that survey completion is not a mandatory or required component of their job, functioning as a situational constraint.

Rogelberg et al. (2000) also proposed organizational norms pertaining to survey completion as a facilitating factor that may enhance the likelihood of response to organizational surveys. If norms in organizations are influential predictors of survey response, then norms pertaining to engagement in helping behaviors at work may also be additional predictors of survey response behavior. This assumption is based on the notion that survey response behavior closely resembles other helping behaviors at work, which may be influenced by organizational norms for engaging in helping behaviors. Other organizational climate aspects that may enhance chances of individuals responding to surveys may pertain to innovation and feedback – individuals who perceive their organization as receptive to new ideas and constructive comments, and who feel voicing ideas is supported and rewarded may be more likely to view an organizational survey as an opportunity to engage in organizationally desired behavior than employees who feel their organization fails to value their feedback and innovative ideas.

Interactions between situational constraints and individual differences variables

Previous nonresponse research has rarely examined interaction effects, despite their potential to further our understanding of survey response behavior. In this section, we discuss the potential moderating effects of personality variables on the influence of situational constraints on survey response behavior.

Situational factors were hypothesized in previous research to reduce or increase chances of individuals to respond to surveys (Rogelberg, Luong, Sederburg & Cristol 2000). Notably, situational constraints may influence the relationship between intentions to respond and actual response behavior. If time constraints are present, or the resources such as available high-speed internet access or proximity to a post office are absent, individuals may – despite good intentions – fail to complete organizational surveys. We assert that the influence of situational constraints on actual response behavior may be moderated by personality and attitudinal factors. In terms of personality, we suggest that for highly conscientious and highly agreeable individuals, high situational constraints are less likely to impact their response behavior. The personality dispositions should lead them to pursue conscientious and agreeable actions even in the presence of obstacles. Individuals who are

high on conscientiousness may, through their attention to detail and their diligent actions, overcome situational constraints and respond despite the presence of constraints. For example, a not very conscientious individual may fail to complete a web-based survey if he or she has no internet connection at home. Highly conscientious individuals, in contrast, may further pursue the option of completing the survey by seeking alternative means of completing it other than using their personal internet connection. Agreeableness may play a similar role – highly agreeable individuals who may want to complete the survey in order to assist those conducting it may try to overcome the situational constraints by seeking alternative means of completion, while individuals low on agreeableness may be less likely to attempt to overcome situational constraints since they are less motivated to provide help or assistance to those organizational members conducting the survey.

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COULD JOB INSECURITY (ALSO) BE A MOTIVATOR?

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Abstract: *This study tested the idea that there is not only a negative effect of job insecurity on performance but also a positive one. The positive effect can be expected because job insecurity might also motivate people to work hard because good performance might be believed to lessen the chance of being made redundant. We assume that both effects work simultaneously but that the negative effect is stronger than the positive one. Furthermore, we assume that the negative effect is mediated by work attitudes. Job insecurity, performance (in-role behavior and organizational citizenship behaviour), and work attitudes (job satisfaction, commitment, and justice perceptions) data were collected from 132 German nonmanagerial employees. Structural equation modeling provided some evidence for the hypothesized relationships. In addition, our data replicate the finding of Borg & Elizur (1992) that there are two separate dimensions of job insecurity with different correlational patterns: cognitive job insecurity (i.e., the probability estimate of loosing one's job) and affective job insecurity (i.e., being worried about loosing one's job).*

Job insecurity is typically seen as a stressor that diminishes job performance (e.g. De Witte 1999), but what if it is also a motivating factor leading to greater work effort? Borg & Elizur (1992) introduced the idea of job insecurity as a motivator into the literature, referring to managers who "frequently argue that job security in organizations has become too high and that an increase in job insecurity would contribute to higher work efforts by employees in order to keep their jobs" (p. 25). Even though this idea has now been around for quite some time, it has never been put to the test. The study that we present here attempts to fill this gap in the literature.

There are at least two reasons why the idea of job insecurity as a motivator has not been focused on by job insecurity researchers. The first is that many research findings accumulated so far support the alternative view – the view of job insecurity as a stressor. Job insecurity is known to be accompanied by being stressed (McDonough 2000) and having worse physical and mental health (Sverke, Hellgren & Näswall 2002). It is also known to

have a negative relationship with work attitudes such as job satisfaction and commitment (Sverke et al. 2002) as well as justice perceptions (Armstrong-Stassen 2003). All of these findings are consistent with the view of job insecurity as a stressor.

The second reason is that empirical evidence favors the view that job insecurity and job performance are more likely to be negatively correlated than positively correlated, even though the correlation varies from study to study. In the meta-analysis by Sverke et al. (2002), job insecurity was not significantly related to (overall) performance in general. Only if job insecurity was measured with a proper scale (as compared to a single item) did the negative correlation become significant. The overall picture is similar (but more inconsistent) if one important aspect of performance, namely organizational citizenship behavior (OCB), is analyzed separately. In one study, the relationship between job insecurity and OCB was found to be negative (King 2000). In the study by Boerner, Dütschke & Schwämmle (2005), only one facet of OCB (civic virtue) was negatively predicted by job insecurity in one sample, but not in the other sample. In the study by Feather & Rauter (2004), job insecurity had a marginally positive relationship with one sample but the (negative) relationship was nonsignificant for the other sample.

On the other hand, the literature does provide a small number of specific hints that experiencing job insecurity can be motivating. Employees believe that good performance lessens their chances of being made redundant (Van Vuuren, Klandermans, Jacobson & Hartley 1991). Thus, people whose jobs are insecure might hope that they will be spared if redundancies are necessary because the company will not want to lose their best performers and will rather lay off the poor performers. In addition, job insecurity is reported to be correlated with longer working hours (Fischer et al. 2005). This might be the case because people who work longer might be perceived as especially committed employees, who might in turn be the last to be made redundant.

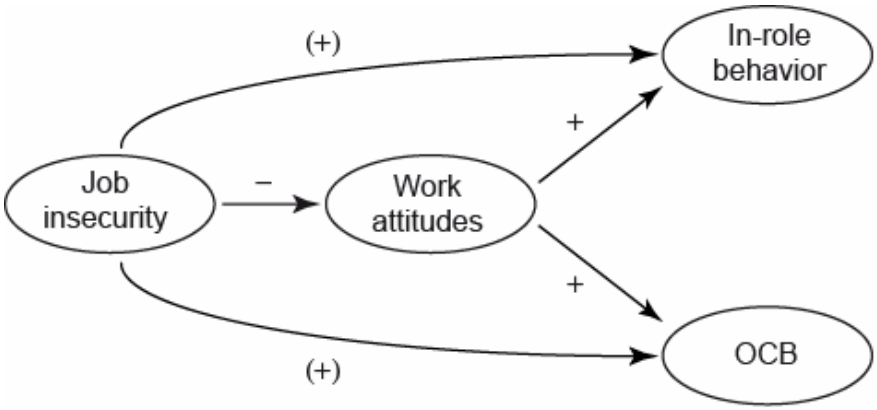
Thus, the evidence accumulated so far offers strong support for the view of job insecurity as a stressor, while the evidence for the view that job insecurity is a motivator is certainly weaker. One could therefore assume that it is not even worth trying to find evidence that job insecurity could also be motivating. Yet, we argue that it might be too early to give up on this idea. However, if one wants to find evidence for the motivating effect of job insecurity, one has to take into account the evidence for the view of job insecurity as a stressor. This means that it is inappropriate to assume that either one view or the other is correct. Instead, both views might be correct at the same time.

If job insecurity is both a stressor and a motivator at the same time, then job insecurity might reduce job performance (due to being a stressor) and it might increase job performance (due to being a motivator). If the effects are of equal strength, then they will cancel

each other out. If one effect is stronger than the other, then the weaker effect will suppress the stronger effect and the resulting relationship will be smaller than expected. The latter scenario seems to be more appropriate given that there is more evidence that job insecurity is negatively related to performance (in particular to in-role behavior). The motivating aspect of job insecurity on performance most likely suppresses the stressing aspect of job insecurity, and the resulting correlation is negative but small.

Structural equation modeling allows the idea to be tested that the motivating aspect of job insecurity on performance most likely suppresses the stressing aspect of job insecurity because it enables the two aspects to be disentangled. This can be carried out with the help of the mediation-and-suppression model, which is shown in Figure 1. According to the view of job insecurity as a stressor, job insecurity should worsen work attitudes, and this should in turn decrease performance (cf. Harrison, Newman & Roth 2006). According to the view of job insecurity as a motivator, there should also be a direct and positive effect of job insecurity on performance. We tested this model with a sample of 132 German employees.

Figure 1 The mediation-and-suppression model of the effects of job insecurity



Furthermore, our data set gave us the opportunity to explore another idea introduced by Borg & Elizur (1992) into the literature: the independence of cognitive and affective job insecurity. Whereas cognitive job insecurity is the perception that one's job is insecure (which is the focus of most thinking, most studies, and also our model), affective job insecurity can be understood as the emotional reaction to imagining loosing one's job. Borg & Elizur showed that cognitive and affective job insecurity are separate constructs. As an additional aim of the current study was to replicate this finding, we also included Borg & Elizur's affective job insecurity items.

Method

Participants

The data used in this study were collected from a facility management company, a health insurance company, and a dental dealer in Germany. Altogether, 210 employees without managerial responsibility were contacted, and 133 sent the questionnaire back (rate of return: 66%). Of these, 54 worked at the facility management company, 52 at the health insurance company, and 27 at the dental dealer. One person in the facility management company had to be excluded because he always used the extreme (and positive) end of the scale, leaving data from 132 employees. Of these 132 employees, 32.6% were male and 63.6% female (3.8% missing). Seventy-six percent had been working at their company for longer than 5 years.

Measures

We used a Likert response scale ranging from (1) *strongly disagree* to (7) *strongly agree* for all measures, which we will now describe in detail.

Job insecurity. Cognitive job insecurity was measured with the four items of Borg's cognitive job insecurity scale that focus exclusively on the perception of the likelihood of loosing one's job (Borg 1992, Sample 2; see also Borg & Elizur 1992). These (reverse-scored) items are: 'My job is secure', 'In my opinion, I will keep my job in the near future', 'In my opinion, I will be employed for a long time in my present job', and 'My workplace is secure in every respect'. Affective job insecurity was measured with the three items of Borg & Elizur ('The thought of loosing my job troubles me', 'The thought of loosing my job worries me', and 'The thought of loosing my job scares me' [own translations]).

Work attitudes. The latent construct work attitudes included job satisfaction, organizational commitment, and procedural and interactional justice perceptions. *Job satisfaction*

was measured with two Job Diagnostic Survey (JDS, Hackman & Oldham 1980) items: 'I am generally satisfied with the kind of work I do in this job' and 'Generally speaking, I am very satisfied with this job'. *Commitment* was assessed with the German translation (Schmidt, Hollmann & Sodenkamp 1998) of N. J. Allen & Meyer's (1990) eight-item measure of affective commitment. *Procedural justice* was measured with a six-item measure developed by Niehoff & Moorman (1993). A sample item is 'All job decisions are applied consistently across all affected employees'. *Interactional justice* was assessed with a six-item scale developed by Moorman (1991) (using the present tense instead of the past tense, for example 'My supervisor considers my viewpoint').

In-role behavior and OCB. These constructs were assessed with the German FELA questionnaire (FELA = 'Fragebogen zur Erfassung des leistungsbezogenen Arbeitsverhaltens' [Questionnaire for measuring performance-related work behavior], Staufenbiel & Hartz 2000). This scale has five subscales (with five items each), which cover in-role behavior and four facets of OCB (altruism, sportsmanship, civic virtue, and conscientiousness). The subscale measures can be combined into one general OCB measure (Staufenbiel & Hartz 2000).

Analysis

Confirmatory factor analyses were run by analyzing the covariance matrix using the maximum likelihood estimation method in LISREL 8.54 (Jöreskog & Sörbom 1996). The following statistics were used to test the fit of the models: chi-square statistics, the non-normed fit index (NNFI), the comparative fit index (CFI), the standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA). Conventionally (e.g. Kline 2005), an NNFI or CFI of less than .90 is an indication of unacceptable fit, as is any SRMR larger than .10 and any RMSEA larger than .08.

Composite indicators (i.e., parcels) were formed for several of the scales in order to reduce the number of parameters and thereby improve the sample-size-to-estimator ratio (Hall, Snell & Foust 1999). The items from the cognitive job insecurity scale were parceled into two indicators. The procedure consisted of assigning items to one of the two indicators depending on the relative size of the factor loadings that resulted from a one-factor principal component analysis. In other words, the item with the highest factor loading was assigned to the first indicator, the item with the second highest factor loading to the second indicator, and the item with the third highest factor loading again to the first indicator and so on. This procedure was used whenever we formed parcels (i.e., for in-role behavior and OCB). For work attitudes, four indicator variables were used: job satisfaction, organizational commitment, procedural justice, and interactional justice.

Results

Descriptive statistics, correlations, and reliabilities of all scores are reported in Table 1.

Table 1 Means, Standard Deviations, Scale Reliabilities, and Pearson Correlations

Variable	*k*	*M*	*SD*	1	2	3	4	5	6	7	8
1. Cognitive job insecurity	4	3.77	1.23	(.84)							
2. Affective job insecurity	3	4.49	1.76	.33**	(.93)						
3. Job satisfaction	2	5.48	1.02	-.52**	-.23**	(.77)					
4. Commitment	8	4.66	.90	-.39**	-.01	.54**	(.78)				
5. Procedural justice	6	3.74	1.21	-.38**	.10	.35**	.52**	(.88)			
6. Interactional justice	6	4.86	1.24	-.46**	-.02	.39**	.42**	.58**	(.92)		
7. OCB	20	5.68	.55	-.22*	.05	.30**	.36**	.25**	.18*	(.82)	
8. In-role behavior	5	6.23	.60	-.18*	-.04	.31**	.18*	.06	.18*	.57**	(.77)

Notes. *k* = number of items. Scale reliabilities appear in parentheses along the diagonal. OCB = organizational citizenship behavior.
$130 \leq N \leq 132$.
* p < .05. ** p < .01

Test of our model

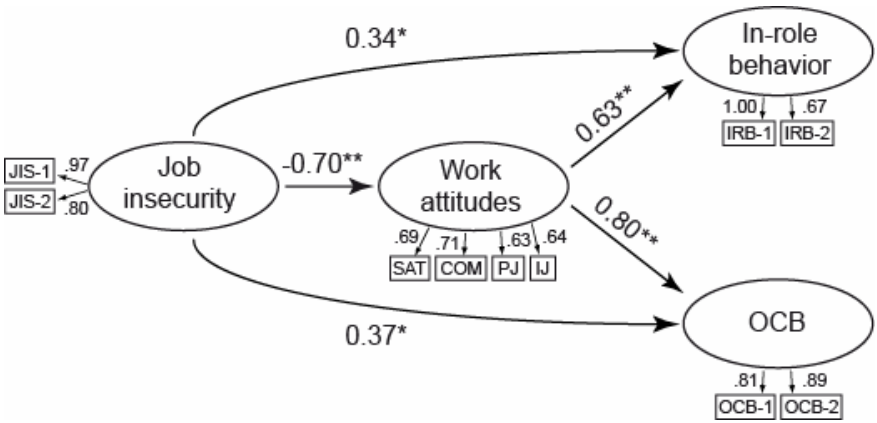
We first tested the fit of a nonmediated model in which there were only direct paths from job insecurity to in-role behavior, OCB, and work attitudes. As Table 2 shows, the nonmediated model did not fit the data. Second, we tested a mediation-only model in which there was a path from job insecurity to work attitudes, a path from work attitudes to in-role behavior, and a path from work attitudes to OCB. The (almost acceptable) fit of this model can also be seen in Table 2. Third, we tested whether there are additional direct and positive paths from job insecurity to in-role behavior and OCB (i.e., the mediation-and-suppression model). Figure 2 shows that such direct paths are indeed positive and statistically significant. Table 2 shows that the fit of this model was just acceptable and significantly better than the fit of the nonmediated model, but not significantly better than the mediation-only model. Thus, these results provide partial evidence for our model.

Table 2 Summary of Goodness-of-Fit Indices

Model	χ^2	*df*	NNFI	CFI	SRMR	RMSEA	$\Delta\chi^2$
Nonmediated	114.86**	32	0.83	0.88	0.14	0.14	17.46**
Mediation-only	101.45**	32	0.87	0.91	0.12	0.13	4.05
Mediation-and-suppression	97.40**	30	0.87	0.91	0.10	0.13	

Notes. $N = 129$. NNFI = nonnormed fit index; CFI = comparative fit index; SRMR= standardized root mean square residual; RMSEA = the root mean square error of approximation. $\Delta\chi^2$ with $df = 2$ relative to mediation-and-suppression model.
$^{**}p < .01$

Figure 2 Structural equation model of the effects of job insecurity



JIS-1 and JIS-2 = cognitive job insecurity, parcels 1 and 2; SAT = job satisfaction; COM = commitment, PJ = procedural justice, IJ=interactional justice, OCB-1 and OCB-2 = organizational citizenship behavior, parcels 1 and 2; IRB-1 and IRB-2 = in-role behaviour, parcels 1 and 2. All paths of the measurement model are statistically significant at $p<.01$. $^{*}p < .05$, $^{**}p < .01$.

Cognitive vs. affective job insecurity

First, we subjected the job insecurity items to an exploratory factor analysis using principal components with varimax rotation. The analysis revealed two factors with eigenvalues > 1 (λ_1=3.58, λ_2=1.78, λ_3=0.58) that explained 76.6% of the variance. The factor loadings (see Table 3) revealed a clean and readily interpretable factor structure, as expected. The first component captures affective job insecurity, and the second component cognitive job insecurity.

Table 3 Descriptive Statistics, Varimax Rotated Factor Loadings and Communalities of the Principal Component Analysis (PCA), and Loadings of the Maximum Likelihood Structural Equation Model (SEM) for the Job Insecurity Items (N=125)

Item	*M*	*SD*	PCA			SEM
			Factor I	Factor II	h^2	Loading
The thought of loosing my job troubles me.	4.20	1.81	0.92	0.18	.88	0.93
The thought of loosing my job worries me	4.51	1.92	0.93	0.13	.89	0.93
The thought of loosing my job scares me.	4.61	1.95	0.90	0.13	.83	0.83
My workplace is secure in every respect.	4.38	1.65	0.27	0.80	.71	0.81
In my opinion, I will keep my job in the near future.	2.92	1.29	0.05	0.79	.62	0.63
My job is secure.	4.17	1.61	0.28	0.81	.73	0.84
In my opinion, I will be employed for a long time in my present workplace.	3.64	1.52	0.02	0.84	.71	0.69
		Explained Variance:	38.38%	38.25%		

Note. Factor I = affective job insecurity; Factor II = cognitive job insecurity. h^2 = communalities.

In addition, a confirmatory factor analysis was conducted. The following indices indicated an acceptable fit: $\chi^2(13) = 25.65$, $p < .05$, NNFI = .97, CFI = .98, SRMR = 0.05, and RMSEA = 0.09. The two latent factors correlated at .41. As can be seen from the last column of Table 3, the standardized factor loadings of this solution were all greater than .62 and statistically significant (all $p < .01$). Furthermore, Table 1 shows that cogni-

tive and affective job insecurity correlated differently with other constructs. Whereas cognitive job insecurity was negatively related to commitment, procedural justice, interactional justice, OCB, and in-role behavior, the correlations of affective job insecurity with these variables were all nonsignificant. Affective job insecurity was only significantly related to job satisfaction (yet to a lesser degree than cognitive job insecurity). Thus, both exploratory and confirmatory factor analyses as well as the correlational pattern show that affective and cognitive job insecurity should be differentiated.

Conclusion

This study tested the idea that there is simultaneously a negative effect of job insecurity on performance (mediated by work attitudes) and a positive effect of job insecurity on performance (because job insecurity might also be a motivator, see Borg & Elizur 1992). Structural equation modeling provided some evidence for this mediation-and-suppression model. On the one hand, the direct paths from job insecurity to the two latent performance variables were positive. On the other hand, the fit of our model was just acceptable and not significantly better than a mediation-only model that only incorporates the negative effect. It is therefore difficult to reach a final conclusion solely on the basis of this study. However, the study does show that it is certainly too early to give up on the idea of job insecurity as a motivator.

Furthermore, our data replicate the finding of Borg & Elizur (1992) that there are two separate dimensions of job insecurity: cognitive job insecurity (i.e., the probability estimate of loosing one's job) and affective job insecurity (i.e., being worried about loosing one's job). This was the result of both exploratory and confirmatory factor analyses. The two factors showed different correlational patterns with performance and work attitudes (except job satisfaction): Whereas cognitive job insecurity was negatively related, affective job insecurity showed a relationship of zero. This implies that job insecurity researchers should not combine affective and cognitive job insecurity items into one scale, as some researchers have done in the past (e.g. Berth, Förster & Brähler 2005; Johnson, Messé & Crano 1984; Størseth 2004).

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THE EFFECTS OF WORK VALUES AND JOB CHARACTERISTICS ON JOB SATISFACTION

MICHAEL BRAUN & MIRIAM BAUMGÄRTNER

Abstract: *Several approaches relate job satisfaction to work values and job characteristics. Quinn & Mangione (1973) used work values to weight domain-specific satisfaction ratings to find out that importance weighting rather reduces the explanatory power of domain-specific satisfaction ratings with regard to some outcome variables, such as overall job satisfaction. Kalleberg (1977) analyzed the effect of both types of variables in their own right. Using US data he concluded that while job characteristics had strong positive relationships with overall job satisfaction, the effect of work values was negative. Borg (1991) found that work values and the evaluation of job characteristics were not independent from each other. Coping strategies can account for linear or v-shaped relationships for different aspects. The present paper replicates selected analyses of previous studies using the International Social Survey Program 1997 study on 'Work Orientations', which includes similar indicators. The study is based on representative samples of full-time employed respondents in a broad variety of national contexts.*

Work values, job characteristics and satisfaction

There are several approaches which relate job satisfaction to work values (i.e., what is regarded as important in a job) and job characteristics or 'rewards' (i.e., what people perceive they actually get from their jobs) and the interaction of both. The main difference between these approaches is how the relationship between the three variable sets is conceived theoretically. One line of reasoning holds that the effect of a specific job characteristic on satisfaction should depend on its importance for the individual. Thus, if someone does not value, say, income, the fact that a job provides a high income should not have a high impact on satisfaction. A second line of reasoning would rather come to the opposite conclusion: the higher the importance given to a job characteristic the lower the satisfaction which should tend to result (at least for a given level of rewards). Moreover, the relationship between work values and job characteristics is far from clear, e.g. whether

work values are an entirely independent factor or whether they are, at least to some degree, a function of job characteristics. A minor distinction regards the selection of measurement devices, in particular for job characteristics, and how these are labeled. Some researchers measure them by asking respondents explicitely how satisfied they are with a given aspect (e.g. income), while others use – in the semantical sense – purely 'descriptive' qualifiers (e.g. 'my income is high') or rather evaluative qualifiers without referring to satisfaction (e.g. 'my income is good'). In the following, we will refer to job characteristics and domain-specific satisfaction ratings. We will briefly sketch the work of several scholars which exemplify the different approaches.

Quinn & Mangione (1973) used importance ratings ('work values') to weight domain-specific satisfaction ratings (such as 'the pay is good'). They found that importance weighting rather reduces the explanatory power of domain-specific satisfaction ratings with regard to some outcome variables, such as overall job satisfaction. The authors compared the correlations of these outcome variables with a variety of predictors based partly on job characteristics alone and partly on using work values as weights. Even the simple mean of job characteristics showed higher correlations with the outcome variables than the more sophisticated measures employing weighting by the importance ratings. They concluded that, while weighting by work values is theoretically sound because the importance workers attach to job characteristics should modulate their effect, this does not show empirically, because "the average worker apparently is one step ahead of the model builders. He is often unobliging enough to engage in his own weighting procedures *before* he provides what the researcher presumes to be 'pure' satisfaction ratings" (Quinn & Mangione 1973: 20). According to these authors, job characteristics without importance weighting are better predictors of overall job satisfaction.

Kalleberg (1977) developed a different approach for dealing with similar indicators: he analyzed the effect of both types of variables, job characteristics and work values, in their own right. Using US data, he found that while the former had strong positive relationships with overall job satisfaction, the effect of work values was negative, i.e., given what workers have attained in their jobs (the 'job characteristics'), the more importance was attributed to job aspects (the 'work values') the lower was overall job satisfaction. Kalleberg explained the negative coefficients of work values as follows: "For a given level of rewards (i.e., holding rewards constant), the more one values those rewards the more likely it is that these values are not fulfilled" (Kalleberg 1977: 133). Moreover, he tested interaction models, with the main effect of job characteristics included together with an interaction effect between job characteristics and work values. The interaction terms were found to be negative which is not compatible with the assumption of Quinn & Mangione that the effects of job characteristics increase with the value attached to them. As a remark of caution he added: "The possibility remains very plausible that values (...) interact with the

'objective' job characteristics to produce evaluative judgments about those characteristics. For example, individuals are likely to develop judgments about or even to merely *notice* characteristics of their jobs to the extent to which the individuals value these characteristics. ... Under these conditions, the job-reward measures *already* represent the interactions between the true job characteristic scores and values" (Kalleberg 1977: 134f).

The potential lack of independence between work values and the perception/evaluation of job characteristics was analyzed by Borg (1991). Unlike Kalleberg, who assumed that the perception of job rewards changed as a function of work values, he rather found the opposite relationship: work values differing as a function of the perception of job characteristics. In the literature, Borg encountered contradicting assumptions on the relationship between work values and domain-specific job satisfaction: on the one hand, that both are positively correlated because people whose work is not satisfactory for a given aspect downgrade this aspect. On the other hand, that there is a v-curved relationship with highest importance ratings both for those who are satisfied with a given job characteristic to a particularly high and a particularly low degree. Previous studies partly supported the former and partly the latter hypotheses, probably due to the fact that sample sizes were usually small and the groups studied were highly selective. Borg provided evidence that both theories hold depending mainly on the perceived controllability of a given job aspect. When someone is dissatisfied with a certain job aspect but feels at the same time that he/she is not capable of actually changing it 'in the real world', he/she would, as a consequence, rather solve it in the 'mental world'. In other words, one would, e.g., devalue this aspect or adjust one's personal standard in order to cope with dissatisfaction. The more these intrapsychic reactions are triggered, the more predominates a linear rather than a v-shaped trend. As found by Borg, the importance ratings of the organization itself show a more linear trend than, e.g., pay and promotion.

The work done by Borg raises the question in which way non-linear relationships between work values and job characteristics might affect overall job satisfaction. Partly independent of this aspect, the previous studies did not address the question for which kinds of workers, defined by the work values they hold, the obtained results apply. As is known, there are only very few workers who do not think work values are important, at least to some degree. Yet, both the Quinn & Mangione and the Kalleberg analyses are based on sample sizes of little more than 1,500 cases. The American part of the survey we are going to analyze here includes, with half the sample size of those studies, only 2 and 6 respondents who think an interesting job is 'not important at all' and 'not important', respectively. This suggests that the results of the analyses of the previous studies are practically restricted to respondents who value job rewards. While Borg tested his hypotheses on a much larger database (7,369), it consisted mainly of organizational surveys in the electronics industry in Europe.

In order to include workers with low work values, a sufficiently large sample size is needed. However, irrespective of the sample size, there will be still much more workers who value a job characteristic to a high degree. As regression results are sensitive to the number of cases, we will use this method only at a preliminary stage of analysis, and switch to a visual representation of the data thereafter. This is also useful as regards the possible non-linear relationships.

Data and methods

The present paper replicates selected analyses of the previous studies using the International Social Survey Program (ISSP; Braun 1994; Davis & Jowell 1990) 1997 study on 'Work Orientations' (Zentralarchiv 2001). The ISSP is based on representative samples of 34,835 respondents in a broad variety of national contexts (25 countries, with separate data for East and West Germans as well as Israeli Jews and Arabs). In this paper, only full-time employed respondents are considered. In all countries taken together their number is 15,673. The questionnaire was drafted in a form that allowed for self-completion. The actual form of administration, however, differed from country to country: it was administered as a mail questionnaire, as a personal interview or as a drop-off following a personal interview.

Work values were measured by the following question: "From the following list, please tick one box for each item to show how important *you personally* think it is in a job. How important is ... job security?, high income?, good opportunities for advancement?, an interesting job?, a job that allows someone to work independently?, a job that allows someone to help other people?, a job that is useful to society?, a job that allows someone to decide their times or days of work?". Answer categories were 'very important', 'important', 'neither important nor unimportant', 'not important' and 'not important at all'. In addition, a 'can't choose' category was offered. The last item of the work-value battery was not asked in a parallel fashion for job characteristics but in a related question outside the respective battery. Therefore, it is not included in the following analyses.

Job characteristics were measured by the following question: "For each of these statements about your main job, please tick one box to show how much you agree or disagree that it applies to *your job*. … My job is secure, My income is high, My opportunities for advancement are high, My job is interesting, I can work independently, In my job I can help other people, My job is useful to society." Answer categories for these statements were 'strongly agree', 'agree', 'neither agree nor disagree', 'disagree' and 'strongly disagree'. In addition, a 'can't choose' category was offered.

Domain-specific satisfaction measures were not included in the ISSP study, while other studies do include such measures in addition to job characteristics (e.g. Habich 1996) or exclusively (e.g. Borg 1991). To some degree, it might be possible to interprete job characteristics as measures for domain-specific satisfaction. As Kalleberg (1977: 131) puts it, "they are evaluative judgements on the part of the respondents concerning features of their jobs (...); in this sense, they may be regarded as representing measures of satisfaction with the various dimensions of jobs." Probably, such an interpretation might be quite adequate for some aspects but not for others. E.g. respondents might say that their income is low but they might nevertheless be fully satisfied with it – given their work input and/or aspirations. In any case, in the present context, job characteristics in a narrower sense are more important than domain-specific satisfaction ratings.

Overall job satisfaction was measured by the question: "How satisfied are you in your (main) job?" Answer categories were 'completely satisfied', 'very satisfied', 'fairly satisfied', 'neither satisfied nor dissatisfied', 'fairly dissatisfied', 'very dissatisfied' and 'completely dissatisfied'. Additionally, a 'can't choose' category was offered.

The main advantage of the ISSP data is that it offers a sufficient number of cases for those who are not satisfied with their jobs and who do not rate the different work values as important. As is generally known, importance ratings in the area of work values are extremely skewed. In order to visualize the effect of the interaction between work values and job characteristics on overall job satisfaction, we, thus, need a big data set. Even in this comparatively large sample, those respondents who regard the different work values as 'not important at all' are few in number and, therefore, the respective curves for this subgroup have to be regarded with caution. Table 1 shows the number of cases in the most critical category 'not important at all' and, for comparative purposes, in the 'not important' category.

Table 1 Number of respondents in 'not important at all' and 'not important' categories of work values

	not important at all	not important
Job security	69	258
High income	103	705
Interesting work	50	276
Independent work	169	894
Help others	155	800
Useful to society	177	812

Data: ISSP 1997; full-time employed respondents.

Results

Country differences in overall job satisfaction, work values, and job characteristics

The mean of overall job satisfaction across all countries is 5.24 with a standard deviation of 1.16. Table 2 shows the means and standard deviations of work values and job characteristics.

Table 2 Means (and standard deviations) for work values and job characteristics

	Work values	Job characteristics
Job security	4.51 (0.70)	3.64 (1.17)
High income	4.05 (0.83)	2.69 (1.08)
Interesting work	4.39 (0.71)	3.88 (0.98)
Independent work	4.04 (0.90)	3.82 (1.12)
Help others	3.90 (0.86)	3.75 (1.07)
Useful to society	3.92 (0.88)	3.92 (0.99)

Data: ISSP 1997; full-time employed respondents.

The cognitive representation of the work-value and job-characteristic items

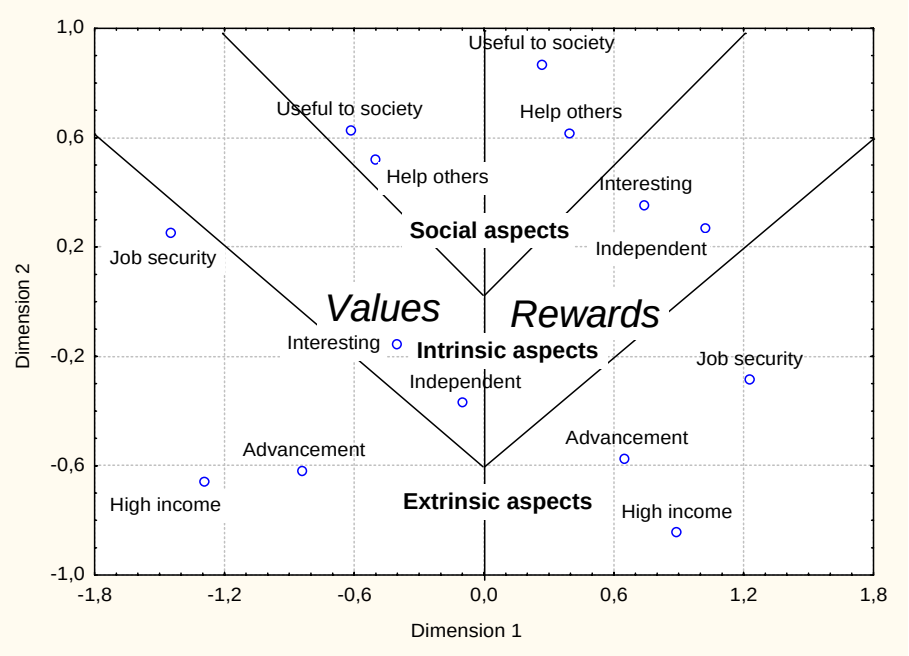
In order to visualize the mental representations of the items, we use Multidimensional Scaling (MDS; see Borg & Groenen 1997; Borg & Shye 1995). MDS represents the intercorrelations of the items in a graphical way. Correlations correspond to the distances between the items. The interpretation of the MDS representation focuses on the correspondence between geometrical characteristics of the configuration and the substantive characteristics of the items.

The items included to measure work values in the ISSP 1997 survey can be grouped, on theoretical grounds, into three regions: 'extrinsic aspects' (secure job, high income), 'intrinsic aspects' (independent, interesting), and 'social aspects' (help others, useful to society). 'Advancement' does not conceptually belong to only one of the three regions, and, in addition, it was found to be located at their intersection by Borg & Braun (1996) for a larger set of items.

Figure 1 shows the joint MDS representation for work values and job characteristics. A partitioning of the space along two criteria is possible: along values vs. rewards as well as along extrinsic, intrinsic, and social aspects. 'Advancement' is stronger connected to the extrinsic aspect, though it is still possible to draw dividing lines in such a way that it forms part of the 'intrinsic' region. Therefore, we will not consider this item in the following. 'Job security' and 'high income', in spite of belonging to the same region, might entail fine but potentially important distinctions. We will come back to this when we present the regression results. The same applies to 'interesting' and 'independent' work. Therefore, no indices are constructed in the following.

When overall job satisfaction were included in the MDS, it would be located in the region of intrinsic rewards close to the point denoting the 'interesting work' reward, a finding in line with the regression results presented below.

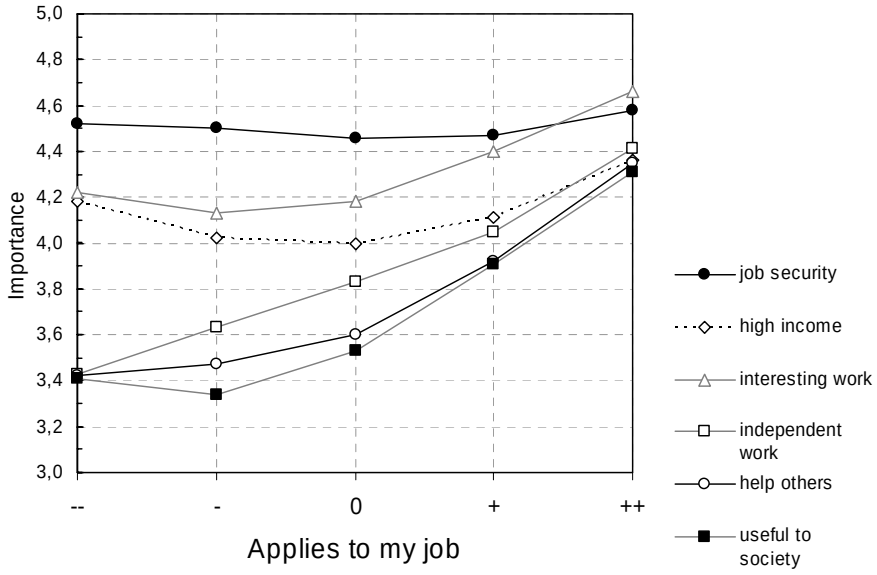
Figure 1 MDS-representation of work values and job characteristics



The relationship between work values and job characteristics

Figure 2 shows the relationships between work values and job characteristics. For job security and high income (and to some degree also: interesting work), there are v-curves with both those who think that the respective job characteristic is given or not given showing higher importance ratings for the extrinsic work values. However, the v-curves are not very pronounced, such that for smaller samples one might come to the conclusion that importance ratings are independent of the job characteristics. For the other aspects, more or less linear relationships hold, whereby work values gain importance the more the respective characteristic applies to one's job.

Figure 2 Mean work values for different levels of the respective job characteristics



Regression of job satisfaction on work values and job characteristics

We will use multilevel regression analysis (Rabe-Hesketh & Skrondal 2005; Raudenbush & Bryk 2002) as our sample comes from a variety of countries. First, we will estimate a variance component model ('empty model') with no predictors. This model shows that only 4.3% of the variance of job satisfaction is located on the country level, while 95.7% is due to differences between workers within countries. Introducing the work values and job characteristics as predictors, 38% of the group-level variance can be explained, i.e., a considerable part of the variance in satisfaction between countries is due to the composition of their respective populations with regard to work values and job characteristics. As for the individual level, the introduction of the explanatory variables leads to an explanation of 27% of the variance. In this model with predictors, only 3.7% of the variance is located on the country level and 96.3% on the individual level. Table 3 shows the fixed effects of the multilevel random-intercept regression of overall job satisfaction on work values and job characteristics.[1]

Table 3 Fixed effects of multilevel random-intercept regression model of overall job satisfaction on work values and job characteristics

	Coefficient	Std.error
Constant	2.35*	0.10
Job security (imp.)	0.06*	0.01
High income (imp.)	-0.05*	0.01
Interesting work (imp.)	-0.05*	0.01
Independent work (imp.)	-0.03*	0.01
Help others (imp.)	0.02	0.01
Useful to society (imp.)	0.01	0.01
Job security	0.09*	0.01
High income	0.16*	0.01
Interesting work	0.47*	0.01
Independent work	0.08*	0.01
Help others	0.02	0.01
Useful to society	0.01	0.01

Data: ISSP 1997; full-time employed respondents; N = 13681; * = significant on .05 level.

1 An additionally estimated random-coefficient model shows some borderline variance components for the random slopes but overall country differences with regard to the regression patterns are small.

Neither the social work values nor the corresponding job characteristics have any effect on satisfaction.[2] The effects of the other work values are relatively small. Whereas the negative coefficients for the extrinsic value of high income as well as for both intrinsic work values correspond with Kalleberg's results (i.e., the more these are valued by a worker, the less satisfied he or she will be). Job security as a work value does not fit into this pattern. Those who value job security more, are likely to be more satisfied. This points at a characteristic difference between the two extrinsic work values considered here: a high income is to some degree a luxury reward, and one is easily disappointed by attaching too much importance to it. In contrast, the security of one's own job represents rather a basic issue, in particular for those who like their present jobs. Thus, it is not surprising that we find a positive correlation between job satisfaction and the importance attached to job security. For the job characteristics, all significant effects are positive, as predicted by Kalleberg,. The strongest effect is found for the intrinsic job characteristic of having an interesting job.

Graphical presentation of the joint effects of work values and job characteristics

In the following, visual means of presentation are used rather than numerical. This is advantageous, as regression results are dominated by frequent patterns, thus potentially blurring the effect that extremely low work values have on job satisfaction. We will select one extrinsic (importance of high income) and one intrinsic work value (importance of independent work) because the tendencies are most pronounced for these. Each figure represents graphically the impact of one work value and the corresponding job characteristic on overall job satisfaction.

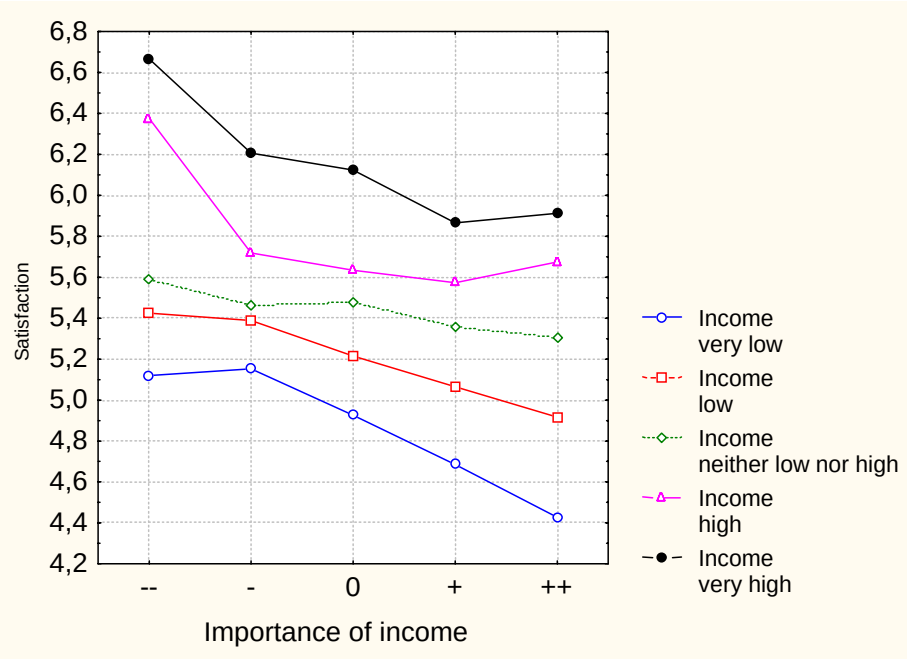
High income

With regard to high income as an extrinsic aspect of work, respondents with low importance ratings show generally higher satisfaction levels, independent of the perceived presence of the respective job characteristic (Figure 3). Also, the more a high income is perceived to be given in one's job, the higher the satisfaction, again for all levels of the importance rating. Satisfaction is especially low for the 'high importance' group when its members perceive their income to be very low. On the contrary, satisfaction is highest when income is not important to a worker while at the same time it is perceived to be very high.

2 This might be partly due to the selection of the particular items included in the survey: both refer to the possibility of some kind of pro-social behavior, which does not fully cover the rewarding potential of social contacts in general.

The practical consequence of this can be stated as follows: it is not wise to attach importance to a high income, as this is likely to decrease the satisfaction level, independent of the actual income a job offers. On the other hand, it is not a bad idea to accept an especially well-paid job (but the worker should not attach to much importance to the pay level).

Figure 3 Effect of importance of high income on satisfaction dependent on how high workers perceive their income to be

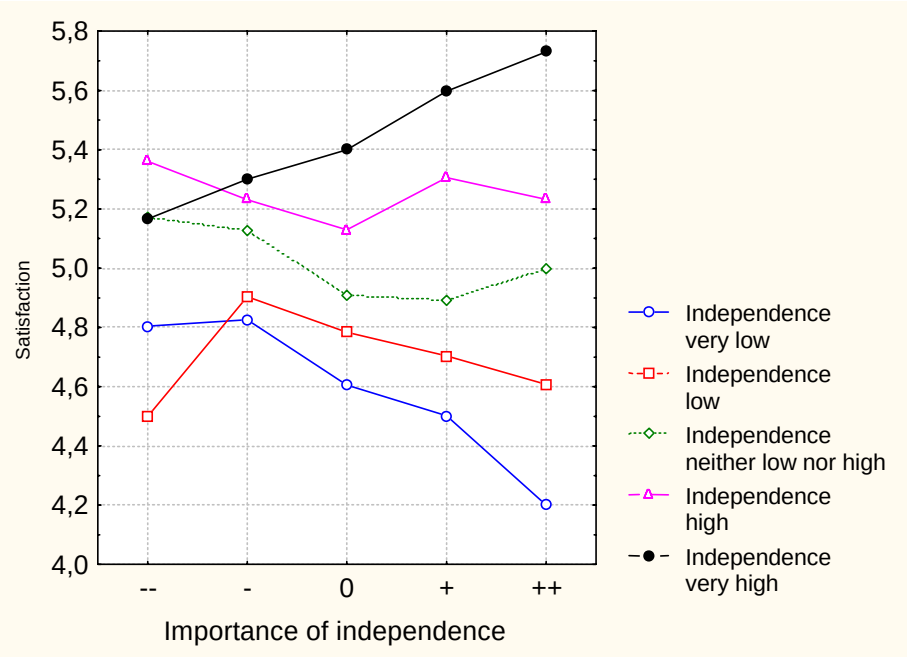


Independent work

Figure 4 shows the corresponding relationships for the intrinsic aspect of independent work. For the independent work, the effect of the work value depends on the concrete value the respective job characteristic assumes, and vice versa. If the possibility to work independently is given to a particularly low degree, high importance ratings reduce satisfaction; while with the job characteristic being perceived to be present to a particularly high degree, a very high importance rating can even increase satisfaction.

The practical consequence can be stated as follows: only those who have jobs that provide them with a high chance to work independently profit from attaching a high importance to independence; all others are well advised to regard independence as less important, otherwise their satisfaction might decrease.

Figure 4 Effect of importance of independent work on satisfaction dependent on how high workers perceive their independence to be



Discussion

The present paper cannot solve all the theoretical and methodological problems encountered in analyzing the nexus of work values, job characteristics, and overall job satisfaction. However, for replicating previous research, the data base used has considerable merits: first, it is large enough to analyze groups of respondents for whom the different work values are less important. Second, the data were collected in a variety of national contexts and, thus, permit to gauge the intercultural generality of the findings. Third, the data came from random samples of the working population and, not being confined to a small number of organizations, permit to gauge the generality of the findings based on organizational surveys. Finally, the partial differences in the behavior of some of the measures usually interpreted as belonging to the same dimension also provide some important insights.

The findings support in part, but not generally, those of Kalleberg (1977): neither have all job rewards a positive effect on job satisfaction nor is the effect of work values always negative. With regard to the social characteristics of work, this result might be due to the specific selection of items which do not fully tap the core of the dimension. The effect of social work values is rather nil than negative. While for high income high work values are always negative, in the case of working independently the effect of high work values becomes negative for those workers, only, who do not perceive the possibility to work independently in their present jobs. For those, who encounter the respective job characteristic to a high degree, however, high importance ratings might rather increase overall job satisfaction. Moreover, this lends support to the explanation proffered by Borg concerning the reduction of the importance of a given value by those who do not encounter the corresponding job reward as a coping mechanism.

The following general – substantive as well as practical – conclusions seem to be warranted: workers' satisfaction is more influenced by the things they perceive in their jobs than by the work values they might or might not have. High importance ratings do not increase satisfaction at all with regard to extrinsic aspects of work, and for intrinsic aspects only if the corresponding job characteristics are perceived to be present to a high degree. To gauge the relative impact of the extrinsic, intrinsic, and social components is more difficult, as the items included in the ISSP survey might be of rather different quality for each of the three.

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ZUMA- Nachrichten Spezial Band 1 (vergriffen)

Text Analysis and Computers

Hrsg. von Cornelia Züll, Janet Harkness und Jürgen H.P. Hoffmeyer- Zlotnik

Mannheim, ZUMA, 1996, 132 Seiten, ISBN 3-924220-11-5

Das Heft entstand im Anschluß an eine internationale Tagung zur computerunterstützten Textanalyse, bei der sich Wissenschaftler aus den verschiedensten Disziplinen trafen. Die hier abgedruckten Papiere der eingeladenen Hauptredner dokumentieren den Forschungsstand in vier Bereichen: Computer-Assisted Content Analysis: An Overview *(E. Mergenthaler*); Computer-Aided Qualitative Data Analysis: An Overview (*U. Kelle*); Machine-Readable Text Corpora and the Linguistic Description of Language (*Chr. Mair*); Principle of Content Analysis for Information *Retrieval (J. Krause*). Der Band ist auch als PDF-Datei im Internet verfügbar (http://www.gesis.org/publikationen/zuma_nachrichten_spezial/).

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ZUMA-Nachrichten Spezial Band 2 (vergriffen)

Eurobarometer. Measurement Instruments for Opinions in Europe

Hrsg. von Willem E. Saris und Max Kaase

Mannheim: ZUMA 1997, ISBN 3-924220-12-3

In der Empirischen Sozialforschung finden in Europa Telefoninterviews anstelle von face to face-Interviews zunehmende Verbreitung. Im Rahmen der zweimal jährlich für die Europäische Kommission in Brüssel durchgeführten Repräsentativbefragungen in den Mitgliedsländern der Europäischen Union, den sogenannten Eurobarometern, ergab sich für die Erhebung vom Frühjahr 1994 (EB 41.0) die Möglichkeit, durch eine zeitgleich mit einem weitgehend identischen Fragenprogramm stattfindende Telefonbefragung in den damaligen zwölf Mitgliedsländern der EU, systematisch Effekte der unterschiedlichen Stichprobenansätze und Erhebungsmethoden zu untersuchen. Dabei konnte das Analysespektrum noch durch eine Telefon-Panelkomponente in dreien der zwölf EU-Länder für das face to face-Eurobarometer erweitert werden. Die Beiträge im vorliegenden Buch untersuchen auf dieser Grundlage methodische und methodologische Fragestellungen, die insbesondere für die international vergleichende Sozialforschung, aber auch für die Markt- und Meinungsforschung in Europa von großer Bedeutung sind. Der Band ist auch als PDF-Datei im Internet verfügbar (http://www.gesis.org/publikationen/zuma_nachrichten_spezial/).

ZUMA-Nachrichten Spezial Band 3

Cross-Cultural Survey Equivalence.

Hrsg. von J. Harkness

Mannheim: ZUMA 1998, 187 Seiten, ISBN 3-924220-13-1

This volume, the third in the ZUMA-Nachrichten-Spezial series on methodological issues in empirical social science research, is devoted to issues of cross-cultural methodology. The focus is on issues of equivalence, the key requirement in cross-national and cross-cultural comparative research. As the contributions indicate, equivalence is, however, better thought of in terms of equivalencies - in social science surveys and in other standardised instruments of measurement. Contributors come from different countries and continents and from widely differing research backgrounds, ranging from linguistics to survey research and its methodologies, to cultural anthropology and cross-cultural psychology. They are: Timothy P. Johnson, Fons J.R. van de Vijver, Willem E. Saris, Janet A. Harkness and Alicia Schoua-Glusberg, Michael Braun and Jacqueline Scott, Ingwer Borg: Peter Ph. Mohler, Tom W. Smith and Janet A. Harkness. This volume can be downloaded as a PDF file (http://www.gesis.org/publikationen/zuma_nachrichten_spezial/)

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ZUMA-Nachrichten Spezial Band 4 (vergriffen)

Nonresponse in Survey Research

Hrsg. von A. Koch und R. Porst

Mannheim: ZUMA 1998, 354 Seiten, ISBN 3-924220-15-8

This volume, the fourth in the ZUMA-Nachrichten Spezial series on methodological issues in empirical social science research, takes up issues of nonresponse. Nonresponse, that is, the failure to obtain measurements from all targeted members of a survey sample, is a problem which confronts many survey organizations in different parts of the world. The papers in this volume discuss nonresponse from different perspectives: they describe efforts undertaken for individual surveys and procedures employed in different countries to deal with nonresponse, analyses of the role of interviewers, the use of advance letters, incentives, etc. to reduce nonresponse rates, analyses of the correlates and consequences of nonresponse, and descriptions of post-survey statistical adjustments to compensate for nonresponse. All the contributions are based on presentations made at the '8th International Workshop on Household Survey Nonresponse'. The workshop took place in September 1997 in Mannheim, Germany, the home base of the workshop host institute, ZUMA. Twenty-nine papers were presented and discussed, of which twenty-five are included here.

ZUMA-Nachrichten Spezial Band 5

A review of software for text analysis

Alexa Melina & Cornelia Zuell

Mannheim: ZUMA 1999, 176 Seiten, ISBN 3-924220-16-6

The book reviews a selection of software for computer-assisted text analysis. The primary aim is to provide a detailed account of the spectrum of available text analysis software and catalogue the kinds of support the selected software offers to the user. A related, more general, goal is to record the tendencies both in functionality and technology and identify the areas where more development is needed. For this reason the presented selection of software comprises not only fully developed commercial and research programs, but also prototypes and beta versions. An additional aspect with regards to the kinds of software reviewed is that both qualitative and quantitative-oriented types of research are included. Depending on research purposes and project design the text analyst can profit from available tools independently of their orientation. The following fifteen programs are reviewed: AQUAD, ATLAS.ti, CoAN, Code-A-Text, DICTION, DIMAP-MCCA, HyperRESEARCH, KEDS, NUD*IST, QED, TATOE, TEXTPACK, TextSmart, WinMAXpro, and WordStat and the criteria and methodology used for selecting them are delineated. Der Band ist auch als PDF-Datei im Internet verfügbar (http://www.gesis.org/publikationen/ zuma_nachrichten_spezial/).

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ZUMA-Nachrichten Spezial Band 6

Sozialstrukturanalysen mit dem Mikrozensus

Hrsg. von Paul Lüttinger

Mannheim: ZUMA 1999, 402 Seiten, ISBN 3-924220-17-4

Im Oktober 1998 veranstaltete die Abteilung Mikrodaten von ZUMA die Konferenz "Forschung mit dem Mikrozensus: Analysen zur Sozialstruktur und zum Arbeitsmarkt", an der vorwiegend Nutzer des Mikrozensus teilahmen. Hauptziel dieser ersten Nutzerkonferenz war es, ein Forum für den Informationsaustausch zwischen den Datennutzern und den statistischen Ämtern zu schaffen. Die mehr als 20 Vorträge gingen deutlich über die von den statistischen Ämtern veröffentlichten Standardergebnisse zum Mikrozensus hinaus und sind weitgehend in diesem Band ZUMA-Nachrichten Spezial abgedruckt. Die Autoren sind: Walter Müller; Karl Brenke; Esther Hansch und Michael-Burkhard Piorkowski; Friedhelm Pfeiffer; Jürgen Schupp, Joachim Frick, Lutz Kaiser und Gert Wagner; Elke Wolf; Dietmar Dathe; Bernd Eggen; Erich Stutzer; Carsten Baumann; Susanne von Below; Thomas Bulmahn; Martin Groß; Reiner H. Dinkel, Marc Luy und Uwe Lebok sowie Wolfgang Strengmannn-Kuhn. Der Band ist als PDF-Datei im Internet verfügbar (http://www.gesis.org/ publikationen/zuma_nachrichten_spezial/).

ZUMA-Nachrichten Spezial Band 7

Social and Economic Analyses of Consumer Panel Data
Georgios Papastefanou, Peter Schmidt, Axel Börsch-Supan,
Hartmut Lüdtke, Ulrich Oltersdorf (Eds.)
Mannheim: ZUMA 2001; 212 Seiten; CD-Rom

Eine von der Abteilung Einkommen und Verbrauch von ZUMA organisierte Arbeitsgruppe hat sich mit datentechnischem Handling und Analysepotential von komplexen Verbraucherpaneldaten, am Beispiel des ConsumerScan Haushaltspanels der Gesellschaft für Marktforschung (GfK, Nürnberg) beschäftigt und die Ergebnisse in einem Symposium im Oktober 1999 vorgestellt. Die überwiegende Zahl der vorgetragenen Arbeiten, die man als Werkstattberichte ansehen kann, sind in diesem Band abgedruckt. Neben einem detallierten Einblick in die Praxis und das Datenerhebungsprogramm von Verbraucherpanels, wie sie z.B. bei der Marktforschungen der GfK unterhalten werden, enthält der Band z.B. Untersuchungen zu Fragen der Flexibilität von Preisbildungsvorgängen, des Lebensstils im alltäglichen Konsums, der Gesundheitsorientierung im Konsumverhalten, der Umweltorientierung und ihrer Umsetzung im Kauf alltäglicher Haushaltungsprodukte. Der Band enthält eine CD-ROM mit Dokumenten und Codebüchern der aufbereiteten ZUMA-Verbraucherpaneldaten 1995. Der Band ist auch als PDF-Datei im Internet verfügbar (http://www.gesis.org/ publikationen/zuma_nachrichten_spezial/).

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ZUMA-Nachrichten Spezial Band 8

Von Generation zu Generation
Hrsg. von Jan van Deth
Mannheim: ZUMA 2002, 68 Seiten, ISBN 3-924220-23-9

Aus Anlass der Ehrung von Prof. Dr. Max Kaase, Prof. Dr. Walter Müller und Prof. Dr. Hansgert Peisert für ihre langjährige und richtungsweisende Mitarbeit in der Mitgliederversammlung des ZUMA e.V. fand am 14. Juni 2002 eine wissenschaftliche Tagung statt. Der Band enthält Beiträge von Jan van Deth, Hubert Feger, Jürgen Rost, Erwin K. Scheuch, Andreas Diekman und Hans-Dieter Klingemann. Die Beiträge sind auch online verfügbar (http://www.gesis.org/publikationen/zuma_nachrichten_spezial/.)

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ZUMA-Nachrichten Spezial Band 9

QUEST 2003

Questionnaire Evaluation Standards

Peter Prüfer, Margrit Rexroth, Floyd Jackson Fowler, Jr. (Eds.)

Mannheim: ZUMA 2004, 216 Seiten, ISBN 3-924220-27-1

This volume, the ninth in the ZUMA-Nachrichten Spezial series on methodological issues in empirical social science research takes up issues of question and questionnaire evaluation. The papers in this volume discuss practical as well as theoretical aspects of questionnaire evaluation. All contributions are based on presentations made at the fourth QUEST (Questionnaire Evaluation Standards) conference which took place from October 21 - 23, 2003 at ZUMA in Mannheim. There were 26 attendees from 9 countries representing 14 organizations: Bureau of Labor Statistics, USA, Center for Survey Research, University of Massachusetts, USA, Institut für Demoskopie Allensbach, Germany, National Center for Health Statistics, USA, National Center for Social Rerearch, U.K., Office of National Statistics, U.K., Statistics Canada, Statistics Finland, Statistics Netherlands, Statistics New Zealand, Statistics Norway, Statistics Sweden, U.S. Census Bureau, ZUMA, Germany. This volume can be downloaded as a PDF file (http://www.gesis.org/publikationen/zuma_nachrichten_spezial/).

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ZUMA-Nachrichten Spezial Band 10

Beyond the Horizon of Measurement

Festschrift in Honor of Ingwer Borg

Michael Braun & Peter Ph. Mohler (Eds.)

Mannheim: ZUMA 2006, 208 Seiten,

ISBN 3-924220-28-X / ISBN 978-3-924220-28-0

This volume was designed as a 'Festschrift' for Ingwer Borg, on the occasion of his 60th birthday. Collaborators and colleagues who work in the research areas of Ingwer Borg (in particular: multidimensional scaling, organizational and employee surveys) were approached to contribute to this book. A pdf version of this volume can also be downloaded from the internet
(http://www.gesis.org/en/publications/magazines/zuma_special/index.htm).

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ZUMA-Nachrichten Spezial Band 11

Methodological Aspects in Cross-National Research
Jürgen H.P. Hoffmeyer-Zlotnik & Janet A. Harkness (Eds.)
Mannheim: ZUMA 2005, 305 Seiten, ISBN 3-924220-29-8

The idea for this volume was born during the Sixth International Conference on Social Science Methodology in Amsterdam in August 2004, organised by the International Sociological Association Research Committee 33 on Logic and Methodology. Most of the contributions in this volume are proceeding papers from the Amsterdam conference.

The contributions in this volume are organised in four parts. The first part deals with designing and implementing cross-cultural surveys. The second part consists of three papers that deal with different issues of comparability or "equivalence". The third part of the volume brings together papers on with harmonising socio-demographic information in different types of surveys. The last section of the volume contains papers that discuss individual socio-demographic variables in cross-national perspective. This volume can be downloaded as a PDF file from December 2007 on (http://www.gesis.org/publikationen/zuma_nachrichten_spezial/).

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ZUMA-Nachrichten Spezial Band 12

Conducting Cross-National and Cross-Cultural Surveys
Papers from the 2005 Meeting of the International Workshop on
Comparative Survey Design and Implementation (CSDI)
Janet A. Harkness (ed.)
Mannheim: ZUMA 2006, 123 Seiten, ISBN 3-924220-31-X

The papers in this volume stem from the third annual meeting of the International Workshop on **C**omparative **S**urvey **D**esign and **I**mplementation (CSDI). Initiated in 2002, the Workshop developed out of cross-cultural symposia held at ZUMA throughout the nineteen nineties. One of CSDI's primary goals is to promote research into methodological issues of particular and sometimes unique salience for cross-cultural and cross-national survey research. For more information visit the CSDI website (www.csdi-workshop.org).

The seven papers are good illustrations of the broad spectrum of research fields in which CSDI researchers are engaged. The volume begins and ends with two framework papers, the first discussing what makes cross-national research special, the last on where we begin to draw boundaries between entities to be compared in "comparative" research. The five remaining papers discuss (in order of the volume): the rich information available from the multinational European Social Survey on data collection; socio-demographic measurement and comparability in the cross-national context, again with reference to the Euro-

pean Social Survey; cognitive pre-testing of translated questionnaires; communicative issues across cultures in telephone interviews; and preliminary work on guidelines on using interpreters underway at the U.S. Census Bureau. The last-mentioned papers reflect research concerns in U.S. cross-cultural contexts. This volume can be downloaded as a PDF file from March 2007 on (http://www.gesis.org/publikationen/zuma_nachrichten_spezial/).

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